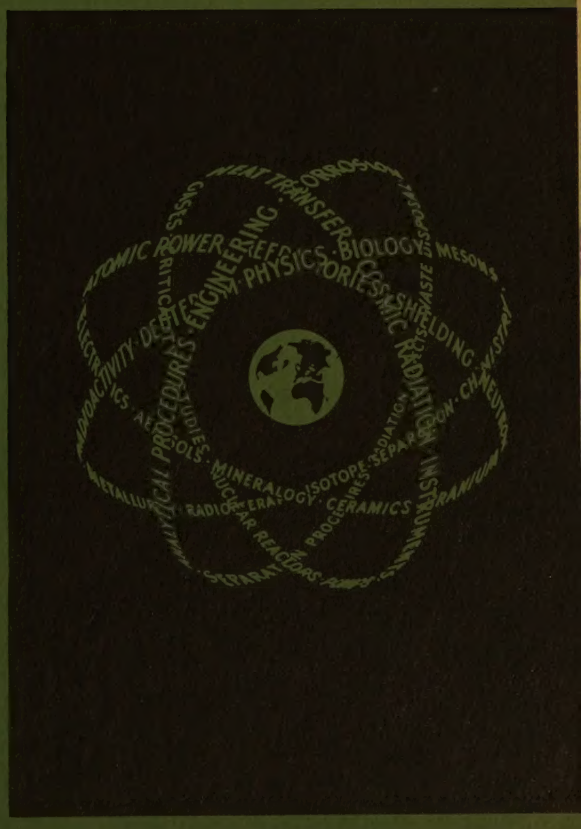
NUCLEAR SCIENCE ABSTRACTS



March 15, 1959

Volume 13 Number 5
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NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 5 March 15, 1959

GENERAL

Refer also to abstracts 3457 and 3466.

2625 APEX-435

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

TECHNICAL INFORMATION ENGINEERING SYSTEM. R. L. Allen, K. D. Brown, J. B. Crabbe, and G. J. Mikulak. July 28, 1958. 18p. Contracts AF33(600)-38062 and AT(11-1)-171. $0.75(OTS).

Part 1 of this document describes the Technical Information Engineering System and its application at GE-ANPD. Part 2 contains a printout of information that is processed and produced by IBM machines according to the methods of the system. A great volume of technical information about ANPD power plants, power plant test assemblies, design considerations, methods, and comparisons is abstracted and placed on IBM cards, which are then arranged and classified by IBM data-processing machines. The system of coding this data permits quick reference and comparison of detailed information for all ANPD power plant designs. The printout illustrates the type of information compiled and the general organization of the information. This printout is a specially unclassified type using unclassified information abstracted from AEC publications describing reactors. (auth)

2626 BNL-515

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] APRIL 1–JUNE 30, 1958. 45p. $1.25(OTS).

Progress in physics, chemistry, biology, medicine, and accelerator and reactor development is briefly summarized. (For preceding period see BNL-502.) (W.L.H.)

2627

RADIOACTIVITY IN RELATION TO THE PHOTOGRAPHIC INDUSTRY AND SOME ASPECTS OF THE MEASUREMENT OF RADIOACTIVE CONTAMINATION. L. J. Moelants and L. de Borger. Industrie chim. belge 23, 1083-98(1958) Oct. (In French)

The photographic industry attempts to protect its fabrication processes from radioactive contamination by taking all possible precautions. For economic reasons, the producers of the primary materials cannot take the same precautions. Therefore, the photographic industry must submit the primary materials to rigorous controls for radioactive contamination. The principal sources of radioactive residues are atomic and hydrogen bombs, reactors, and the utilization of radioisotopes. The measurement of the radioactive contamination of the atmosphere is made regularly. (tr-auth)

2628

JAPANESE NUCLEAR TANKER PROJECT. The Motor Ship 39, 125(1958).

The design of a 65,000-ton nuclear-powered tanker is described. The initial plans called for a pressurized-water reactor and turbine system. However, research is being made on the development of a gas-cooled reactor operating in conjunction with gas turbines. (J.S.R.)

2629

DIE WIRKUNGEN VON KERNEXPLOSIONEN. WAFFENTECHNISCHE ANWENDUNG NUKLEARER ENERGIE. (The Effects of Nuclear Explosions. Applications of Nuclear Energy in Weapon Technology.). Rudolf Schrader. Frankfurt am Main, Verlag Soldat und Technik im Umschau Verlag, 1958. 117p.

In the introductory chapter, a brief summary is given of the history and scientific and technical aspects of the development of nuclear weapons. As the book is intended primarily for the layman, the structure of the atom, the processes of fission, and thermonuclear reactions are described simply. The subsequent chapters deal with the energy of nuclear explosion, radioactive fission products, radiation, biological effects of ionizing radiation, description of the discharge of a nuclear explosion, and the pressure, thermal, and radiological effects of a nuclear explosion. (J.S.R.)

2630

ASPECTS ECONOMIQUES DES APPLICATIONS INDUSTRIELLES DE L'ENERGIE NUCLEAIRE (Economic Aspects of the Industrial Applications of Nuclear Energy). Thomas Reis. Paris, Dunod, 1958. 383p. (In French)

The economic evaluation of nuclear energy is a function of a large number of variables and hypotheses to which no absolute values may be assigned. However a large number of technical-economic studies have been made, especially in the United States. An attempt is made to assemble these studies so as to find a unity in the methods of calculating these variables and to apply these methods to specific cases. The utilization of nuclear reactors for the production of electrical energy and fissionable materials is, at present, the most important application. Reactors, therefore, are discussed in great detail, and the technical factors influencing the cost/kw are considered. The utilization of nuclear reactors for propulsion of ships, planes, and land vehicles is then discussed. The application of radiations in the chemical industry and in agriculture and food

preservation is considered in the next two chapters. Research reactors are discussed. The final chapter considers the application of nuclear energy as a heat source. 238 references. (J.S.R.)

2631

REPORTS ON THE PRODUCTIVE USES OF NUCLEAR ENERGY. NUCLEAR PROCESS HEAT IN INDUSTRY. George Perazich. Washington, National Planning Association, 1958. 53p. $1.25.

This study is specifically concerned with the analysis of potential applications of nuclear reactors for the production of heat energy suitable for processing raw materials into semi-finished or finished products, rather than for generating electricity. In low-temperature applications the near-term possibilities of using nuclear process heat appear to be as economically promising in the United States as those of nuclear electricity. It is shown that nuclear energy has the best chance of competing with conventional fuels in those establishments in which low-pressure steam is used in large blocks, where productive processes are continuous, and where plants operate on a year-round basis. The paper industry appears to be especially promising as a potential market. The chemical industries also use large quantities of low temperature process heat. Rubber, petroleum, and probably salt and sulfur mining are other examples of large processing industries in which nuclear heat might become important. (J.S.R.)

BIOLOGY AND MEDICINE

2632 AECU-3844

Bjorksten Research Foundation, Madison, Wis.

FUNDAMENTALS OF AGING—INSOLUBILIZATION OF PROTEIN AS A FUNCTION OF AGING. Quarterly Report No. 2 [for] July 1, 1958—September 30, 1958. 13p. Contract AT(11-1)-606. $3.30(ph OTS); $2.40(mf OTS).

Shrinkage temperature studies on the tail tendons of rats indicate the possible role of cross-linking in natural aging. Rats were irradiated for use in a study of the parallels between irradiation phenomena and aging. (C.H.)

2633 AECU-3914

Los Alamos Scientific Lab., N. Mex.

BIBLIOGRAPHY ON SPACE MEDICINE. Ruth M. Hendrickson, comp. Mar. 7, 1958. 47p. Contract [W-7405-eng-36]. (D-BIB-21). $7.80(ph OTS); $3.30 (mf OTS).

The literature between 1940 and 1957 was searched for information which might be applicable to predictions concerning the fate of man in space. (C.H.)

2634 BNL-504

Brookhaven National Lab., Upton, N. Y.

BIBLIOGRAPHY ON THE EFFECTS OF IONIZING RADIATIONS ON PLANTS, 1896—1955. Arnold H. Sparrow, John P. Binnington, and Virginia Pond. July 1958. 227p. $2.25(OTS).

This bibliography offers a detailed and comprehensive coverage of the literature pertaining to effects of ionizing radiation on plants beginning with early work in radiobotany and including developments through 1955. Occasional editorial remarks indicate species, type of radiation, whether the reference is a review or bibliography, and, when the title is ambiguous, the nature of the article. A subject index is included. (C.H.)

2635 NYO-2426

Worcester Foundation for Experimental Biology, Shrewsbury, Mass.

THE SEPARATION AND CHARACTERIZATION AS REGARDS RADIATION SENSITIVITY OF THE PROTEINS OF LYMPHOID TISSUE. Final Technical Report [for] Period July 1, 1952—September 30, 1958. Eugene L. Hess. Oct. 1, 1958. 12p. Contract AT(30-1)-2084. $3.30(ph OTS); $2.40(mf OTS).

Results are summarized from a study of the macromolecular composition of lymphatic tissue. The cytoplasmic constituents found in extracts of thymus and palatine tonsils from rabbits and calves were analyzed following chemical fractionation. The cytoplasm of these cells was found to contain at least four, and possibly more, PNA-type nucleoproteins. Extraction procedures, are described and data are included on solubility behavior, chemical and physical properties, and radiation effects on isolated and purified components. (C.H.)

2636 UCRL-8524

California. Univ., Berkeley. Radiation Lab.

ENERGY RECEPTION AND TRANSFER IN PHOTOSYNTHESIS. Melvin Calvin. Sept. 23, 1958. 37p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The basic information about the path of carbon in photosynthesis is reviewed, together with the methods that were used to discover it. This has led to the knowledge of what is required of the photochemical reaction in the form of chemical species. Attention is then directed to the structure of the photochemical apparatus itself insofar as it is viewable by electron microscopy, and some principles of ordered structure are devised for the types of molecules to be found in the chloroplasts. From the combination of these, a structure for the grana lamella is suggested and a mode of function proposed. Experimental test for this mode of function is underway; one method is to examine photoproduced unpaired electrons. This is discussed. (auth)

2637 USNRDL-TR-271

Naval Radiological Defense Lab., San Francisco.

SPECIFIC HEMAGGLUTININS IN X-IRRADIATED, BONE MARROW TREATED MICE FOLLOWING DIFFERENTIAL IMMUNIZATION OF HOST AND DONOR. R. M. Garver, G. W. Santos, and L. J. Cole. Oct. 13, 1958. 34p.

An effort was made to evaluate the immunological capabilities of the x-irradiated (870 r), bone marrow-treated mouse, with respect to the relative contribution of the host's own tissues and of the cellular elements derived from the injected bone marrow. In one experiment rats and mice to be used as bone marrow donors were sensitized to one of two antigens (sheep or human erythrocytes). The mice to be used as irradiated recipients were sensitized to the other antigen. In another experiment, mice were used as both bone-marrow donor and host, and either the donor or host, or neither one, was sensitized to either sheep or human erythrocytes. Groups from each experiment were given booster injections of antigen at various times after irradiation. Anti-sheep-erythrocyte and anti-human-erythrocyte agglutinin titers were determined on each group at periodic intervals after irradiation. All marrow-treated irradiated mice continued to produce antibodies if sensitized prior to irradiation. The isologous bone marrow-treated pre-sensitized mice reacted to a

booster with a secondary response, while the heterologous bone marrow-treated mice did not. The isologous bone marrow-treated mice were capable of a primary response, but the heterologous bone marrow-treated mice were not. The results may be interpreted as evidence that the primary response is radiosensitive and antibody production is relatively insensitive. The secondary immune response is relatively radioresistant. Treatment with isologous bone marrow leads to recovery of essentially normal immune response in the isologous chimaeras. In the heterologous chimaera, the immune response is, at all times, at a very low level. (auth)

2638 USNRDL-TR-278
Naval Radiological Defense Lab., San Francisco.
EFFECT OF WHOLE-BODY X-IRRADIATION ON GLUCOSE OXIDATION BY RAT SMALL INTESTINE MUCOSA IN VITRO. R. E. Kay and C. Entenman. Nov. 4, 1958. 35p.

A method was developed for determining the rate of glucose oxidation by rat small intestine mucosa in vitro. Results from studies of the oxidation of carbon-14 labeled compounds indicate that the increase in glucose oxidation by rat small intestine mucosa following x irradiation is due entirely to increased citric acid cycle activity. In addition, the results suggest that x irradiation causes a decrease in oxidation of glucose by extraglycolytic pathways but does not affect the oxidation of glucose by way of the Embden-Meyerhof pathway. (C.H.)

2639 AEC-tr-3353
REVIEWS ON RADIOBIOLOGY. (Ocherki po Radiobiologii). A. M. Kuzin, ed. Translated by David Franklin from a publication of the Institute of Biological Physics, Academy of Sciences, U.S.S.R., Moscow, 1956. 403p. $4.25(OTS).

Separate abstracts have been prepared on four sections of this report. (C.H.)

2640 AEC-tr-3353(p.4-124)
BIOCHEMICAL FUNDAMENTALS OF THE BIOLOGICAL ACTION OF IONIZING RADIATION. A. M. Kuzin. p.4-124 [of] REVIEWS ON RADIOBIOLOGY. 120p.

Contemporary ideas concerning the biochemical fundamentals of the biological action of ionizing radiation are reviewed. Both literature material and the results of original research are included. Topics discussed include the action of ionizing radiation on water, simple proteins, conjugated proteins, lipids, enzymes, vitamins, and on metabolism. (C.H.)

2641 AEC-tr-3353(p.126-230)
THE NERVOUS SYSTEM AND IONIZING RADIATIONS. N. N. Livshits. p.126-230 [of] REVIEWS ON RADIOBIOLOGY. 105p.

The role of the nervous system in the reactions of the organism to the action of ionizing radiations, and the direct action of ionizing radiations on the nervous system are considered in detail. (C.H.)

2642 AEC-tr-3353(p.231-300)
EXPERIMENTAL STUDY OF THE ACTION OF IONIZING RADIATIONS ON MAMMALS. N. I. Shapiro. p.231-300 [of] REVIEWS ON RADIOBIOLOGY. 70p.

Present knowledge of the action of ionizing radiations on mammals is reviewed. Topics discussed in detail include the pattern of lethal effects of radiation, the dependence of biological effects on action dose, the comparative effectiveness of the biological action of various forms of radiation, influence of fractionated and chronic irradiation, the biological effects of irradiation from internally-deposited sources, and experimental changes in the radiosensitivity of mammals. (C.H.)

2643 AEC-tr-3353(p.301-97)
MORPHOLOGICAL CHANGES OF THE NUCLEUS AND CHROMOSOMES UNDER THE INFLUENCE OF VARIOUS KINDS OF RADIATIONS. L. P. Breslavets. p.301-97 [of] REVIEWS ON RADIOBIOLOGY. 97p.

The actions of various types of radiation on the nucleus and chromosomes of plant cells are discussed. Included are the biological effects of x and gamma radiations, electrons, neutrons, ultraviolet light, and infrared rays. (C.H.)

2644 AEC-tr-3432
USE OF RADIOACTIVE CARBON C^{14} IN THE STUDY OF PHOTOSYNTHESIS. (Metody primeneniya radioaktivnogo ugleroda C^{14} dlya izucheniya fotosinteza). O. V. Zalenskii, O. A. Semikhatova, and V. L. Voznesenskii. Translated from a publication of the Academy of Sciences, S.S.S.R., Moscow (1955). 111p. $1.50(OTS).

A comprehensive study is reported of applications of carbon-14 in the study of the physiology of photosynthesis. Apparatuses used in the studies are described and illustrated. Carbon-14 was used in investigations of photosynthesis under both laboratory and natural conditions. Investigations were made of both the rate of photosynthesis and the composition of photosynthetic products following the fixation of carbon. 115 references. (C.H.)

2645 AEC-tr-3511
RESTORATION FROM INHIBITION OF BACTERIAL CELL DIVISION. Hiroshi Matsushita. Translated for Oak Ridge National Lab. from Kagaku 25, 137-8(1955). 6p.

An investigation was made of the effects of irradiation with visible and near ultraviolet light on inhibition of cell division induced in Escherichia coli by exposure to x radiation, ultraviolet light, or nitrogen mustard. Data are tabulated. (C.H.)

2646 HW-56559
THE DAMAGING EFFECT OF P^{32} ON THE OVARY. K. H. Reiher and G. Lang. Translated by B. Kawin (Hanford Atomic Products Operation) from Strahlentherapie 98, 453-63(1955). 15p.

The authors made intravenous injections of radiophosphorus into albino rats. One group received 0.3 μc/g, another group 0.6 μc/g, and a third group 1.2 μc/g of P^{32}. They subsequently investigated the morphological changes of the ovaries after several periods of time amounting to 36 hours and 3, 6, 12, and 30 days. Morphological changes were found only at a dose of 1.2 μc/g. (auth)

2647 NP-tr-195
ON RADIOSENSITIVITY. L. Kreyberg. Translated by J. B. Sykes (U.K.A.E.A., Atomic Energy Research Establishment) from Nord. Med. 59, 827-32(1958). 17p.

The mechanisms of radiation effects on animal cells are reviewed. Differences in the response of various tissues to radiation are discussed. (C.H.)

2648 NP-tr-196
CHEMICAL PROTECTION AGAINST IONISING RADIATION. A. Pihl and L. Eldjarn. Translated by J. B. Sykes (U.K.A.E.A., Atomic Energy Research Establishment) from Nord. Med. 59, 833-6(1958). 19p.

The mechanism by which various chemicals afford

protection to mammals against the effects of ionizing radiations are reviewed. (C.H.)

2649

RADIATION DOSE MEASUREMENTS AND LEUCOCYTE COUNT IN RABBITS. M. Helde, T. Wahlberg, et al. (Karolinska Institutet, Stockholm; Karolinska Sjukhuset, Stockholm; and Research Inst. of National Defence, Sundbyberg, Sweden). Acta Radiol. 50, 477-89(1958) Nov.

The changes in the leucocyte counts in rabbits as a function of the irradiation data seem to verify observations in human subjects. In both instances the frequency of the observed changes was found to be primarily related to the dose-rate, i. e. mr per unit time of irradiation rather than to the total dose administered. This very short unit time has been designated the biological relevant time. (auth)

2650

THE BIOLOGICAL EFFECTS OF SMALL IONIZING RADIATION DOSES. A. V. Lebedinskii, Yu. G. Grigor'ev, and G. G. Demirchoglyan. Atomnaya Energ. 5, 310-20(1958). (In Russian)

Biological effects of small doses of ionizing radiation in short or continuous exposures are analyzed. (R.V.J.)

2651

FAST ANALYSIS OF FORMED BLOOD ELEMENTS WITH A NEW AUTOMATIC COUNTER APPARATUS (CONTRIBUTION TO THE FURTHER KNOWLEDGE OF RADIATION INJURIES IN NUCLEAR CATASTROPHES). I. K. Damminger and E. H. Graul (Philipps Univ., Marburg/Lahn, Ger.). Atompraxis 4, 375-81(1958) Oct. (In German)

This article shows that "biological" dosimetry for measuring radiation-induced damage (especially resulting from nuclear radiation) in the human organism is the only dependable method. The true picture of radiation doses by means of physical measurement (i.e., film dosimetry) can only be evaluated in conjunction with "individual biological dosimetry" as this provides insight as to the actual radiation damage. At present the peripherical blood picture, especially the quantitative reaction of the formed blood elements after exposure to radiation, is the most practical indicator for an early diagnosis of radiation damage. By the use of a new automatic blood cell counter and new methods developed in connection with this instrument, a practical method of counting platelets, was developed which permits a quick early diagnosis of radiation damage. The EEL blood cell counter permits much quicker and more accurate counts of the formed blood elements than methods used to date. In addition to this, changes caused by radiation doses of approximately 10 r can be measured after only 30 minutes so that a prognosis on the expected course of the radiation syndrome is possible. The importance of this new instrument for radiation biological research is stressed. (auth)

2652

RADIATION CHEMISTRY IN RETROSPECT AND PROSPECT. THE SILVANUS THOMPSON MEMORIAL LECTURE. F. S. Dainton (The Univ., Leeds, Eng.). Brit. J. Radiol. 31, 645-59(1958) Dec.

Problems of radiation chemistry are reviewed, with emphasis on the actions of ionizing radiations on living systems. Results from past studies are summarized, and areas are delineated where future investigations are needed. The effects of radiation on aqueous systems are discussed in detail. (C.H.)

2653

ATTEMPTS AT MODIFICATION OF THE RADIATION RESPONSE OF NEOPLASMS BY THE ADMINISTRATION OF "HEMATOPORPHYRIN." Robert Bases, Alexander Pearlman, Rieva Rosh, and Sidney Rubenfeld (New York Univ.-Bellevue Medical Center and Bellevue Hospital, New York). Cancer 11, 1119-24(1958) Nov.-Dec.

A solution of hematoporphyrin was administered intravenously or locally to patients with advanced carcinoma. This was combined with treatment by ionizing radiation. There was no evidence of a potentiating effect when the hematoporphyrin was injected intravenously. In the group of 5 patients in whom the tumors were injected locally, there was an enhanced radiation effect in 1 patient. Aspects of the tumor-localizing properties of hematoporphyrin are discussed. (auth)

2654

TUMORIGENESIS IN OVARIES OF MICE AFTER X IRRADIATION. Mary J. Guthrie (Detroit Inst. of Cancer Research). Cancer 11, 1226-35(1958) Nov.-Dec.

Tumorigenesis in the ovary of the mouse after total-body x irradiation has been studied in serial sections of ovaries recovered at frequent intervals after irradiation. Although the sequences are different from those observed in the intrasplenic ovary of the castrate mouse, tumorigenesis begins in both cases in an ovary depleted of its characteristic oocytes and granulosa cells. This cellular imbalance or premature aging is believed to be the primary condition for the abnormal growth in an otherwise normal animal. (auth)

2655

INDIRECT EFFECTS DURING X-RADIATION OF MALIGNANT TUMORS. M. H. Silk, A. O. Hawtrey, and I. J. C. Macintosh (Liesbeek Cancer Research Clinic, Rosebank, Cape Town). Cancer Research 18, 1257-62 (1958) Dec.

The respiratory and glycolytic metabolism of several nonmalignant and tumor tissues have been compared in normal peripheral dog lymph and in peripheral dog lymph withdrawn from corresponding normal tissues of the same animal 3 hours after a dose of 450 r x radiation. With bicarbonate $\rightleftharpoons CO_2$ buffering, tumor tissues were found to show lower values of respiration and glycolysis in the peripheral lymph from x-irradiated tissues than in normal peripheral lymph. Conversely, the respiration of a nonmalignant tissue was found to be enhanced in the lymph from x-irradiated tissues. When the bicarbonate $\rightleftharpoons CO_2$ buffer system of the lymph was artificially replaced by phosphate, the opposite effect was observed, i.e., the respiration of tumor tissues was enhanced in the lymph from x-irradiated tissues, while the respiration of nonmalignant tissues was depressed. The influence of the buffer system and the effect of dissolved anesthetic in the lymph have been discussed. The results provide evidence in support of an indirect action during x irradiation of malignant tumors. It is suggested that absorption of radiation by the normal cells of the tumor bed and stroma of a neoplasm may cause these cells to liberate biologically active substances into the interstitial fluid. Diffusion of this interstitial fluid throughout the tumor mass could

then provide an environment in which the respiratory metabolism of malignant cells appears to be depressed, while that of nonmalignant cells appears to be enhanced. (auth)

2656

THE SENSITIVITY TO X-RADIATION OF TRADESCANTIA PALUDOSA AT DIFFERENT PHASES OF THE FIRST POSTMEIOTIC MITOSIS. N. L. Delone (Inst. of Biophysics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 582-5(1958) Oct. 1. (In Russian)

Microspores of Tradescantia paludosa were irradiated at the early and late interphases and prophase of the first postmeiotic mitosis. The tabulated data on chromosome reconstruction in x-irradiated microspores show that the sensitivity of cells in the prophase is twice as pronounced as in the interphase; the late interphase is somewhat more sensitive than the early one. The complex causes of differences in sensitivity are discussed, and various factors responsible for the chromosome sensitivity at various phases of cell development are described. (R.V.J.)

2657

THE EFFECT OF RADIOACTIVE STRONTIUM UPON SURVIVAL AND PROPAGATION IN DAPHNIA MAGNA. G. D. Lebedeva and S. G. Sinevid. Doklady Akad. Nauk S.S.S.R. 122, 586-8(1958) Oct. 1. (In Russian)

Effects of Sr^{90} - Y^{90} with concentrations of 3.4×10^{-10} and 3.4×10^{-6} c/l were studied on four generations and with concentrations 3.4×10^{-7}, 3.4×10^{-5}, and 3.4×10^{-4} c/l on two generations of Daphnia magna. Results showed that a Sr^{90} concentration of 3.4×10^{-10} c/l does not effect the life cycle survival of Daphnia magna but induces a slight increase of progeny. Concentrations of 3.4×10^{-7} to 3.4×10^{-3} c/l during two weeks increase the number of progeny which is followed by a depressive effect resulting in total number of progeny equal to that of the control species. In concentrations of 3.4×10^{-3} c/l the progeny appeared in the original Daphnia; in a weeks time all the progeny perished. The survival of Daphnia in Sr^{90} concentrations of 3.4×10^{-5} and 3.4×10^{-4} c/l is reduced 10 to 16 days. The lowest level of survival is at 3.4×10^{-3} c/l, the original Daphnia surviving for two weeks but the second generation only one week. Concentrations of Sr^{90} from 3.4×10^{-10} to 3.4×10^{-3} c/l do not induce visual morphological changes in Daphnia magna. (R.V.J.)

2658

EFFECTS OF IONIZING RADIATION UPON THE NUCLEAR APPARATUS OF SEXUAL CELLS IN THE APE MALES. G. G. Tinyakov and M. A. Arsen'eva (Inst. of Biophysics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 589-92(1958) Oct. 1. (In Russian)

Data are presented on the cytological studies of spermatogenesis of apes exposed to x-radiation doses of 150 to 500 r. The studies were concerned mostly with the dividing spermatogenes in order to determine the composition of Macaca mulatta chromosome complex and with dividing spermatocytes of the first order for determining the character of chromosome reorganization taking place under the action of ionizing radiation. Tabulated data show that sperm of ape No. 1 irradiated with 150 r and killed two years later underwent 5% of anaphase changes; the sperm of the No. 2 ape irradiated with 450 r and killed two years later showed a disturbance about 6%; in the ape No. 3, irradiated with 400 r and killed 11 days after, the disturbance is about 28%. Such a great number of anaphase changes indicate considerable chromosome disturbances, which within two years eliminate the most damaging ones and multiply the least damaging to 5 or 6%. Consequently, it may be deduced that the part of the chromosome reorganization resulting from irradiation, while multiplying, may retain and induce new different reorganization during the span of the animal's life. Hence, the opinion that after a long interval and repairing processes the organism re-establishes the normal fertility is erroneous. Moreover, the radioinduced disturbances may induce various pathological effects in the mammals and their progeny. (R.V.J.)

2659

AGE CHARACTERISTICS IN THE STRUCTURE OF APE TESTES AND THEIR REACTION TO IONIZING IRRADIATION. G. G. Tinyakov, M. A. Arseneva, and Yu. S. Bocharov (Inst. of Biophysics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 799-801(1958) Oct. 11. (In Russian)

Histological studies of mature Macaca mulatta exposed to a single dose of 150 to 400 r and examined 2 years after exposure show externally normal spermatogenesis though pycnotic degenerated nuclei present oftener than in standards. However, in young apes exposed to radiation prior to sexual maturity (2 year old) and examined 2 years after the exposure, spermatogenesis was retarded in comparison to standard. A large number of pycnotic nuclei were found in the sperm ductules and cases of asynchronous development were observed in the sperm ductules. Doses over 450 r induce total sterility in the male ape. (R.V.J.)

2660

ESTROGENS AND THE NATURAL SENSITIVITY OF MICE TO X-RAYS. N. I. Shapiro, E. M. Bocharova, and N. N. Kuznetsova (Inst. of Biophysics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 802-5(1958) Oct. 11. (In Russian)

Analysis of the tabulated experimental data indicates that radiosensitivity responses of normal and castrated female mice do not differ. Also, radiosensitivity of female mice at various estral cycle stages remains unchanged. (R.V.J.)

2661

THE EFFECT OF IONIZING RADIATION UPON THE CHEMICAL COMPOSITION OF MITOCHONDRIA. B. A. Rubin and A. V. Mikheeva (Back Inst. of Biochemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 867-9(1958) Oct. 11. (In Russian)

After irradiation the content of phospholipids increases, especially in mitochondria (up to 245%). Obviously, the ionizing radiation weakens the bond between phospholipids and albumen which results in increased number of phospholipids. The differences in the phospholipid content in irradiated and standard tubers do not disappear after a long storage. Studies of radiation effects on the chemical composition of mitochondria separated from the tissue of irradiated tubers show that the content of phospholipids and nucleic acids in tuber pulp is not affected by irradiation. Consequently, the radioinduced changes in oxidizing ferment activity should be related to disturbances in the integral structure and chemical composition of mitochondria. (R.V.J.)

2662

THE DOSE-EFFECT RELATION. PROBLEMATICS AND RESULTS IN THE IRRADIATED RABBIT EYE LENSES. H. Oeser and E. Krokowski (Univ. of Berlin). Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 467-72(1958) Oct. (In German)

A nonconstant relationship is demonstrated between dose and effect on somatic radiation injury, i.e., weight changes in the lens. A linear dose dependence could be shown to have statistical validity for an intermediate phase within the usual course of a radiation reaction. In conclusion, various problems arising from this are discussed. (auth)

2663

GONAD DOSES IN THE X IRRADIATION OF SOME SO-CALLED MILD ILLNESSES. R. Glauner, D. Messner, and P. O. Thelen (Marienhospitals and Technischen Hochschule, Stuttgart). Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 473-9(1958) Oct. (In German)

Measurements of gonad doses were carried out on men and women using ionization chambers. In women the measurements were made in the vagina. Gonad doses were measured in patients who received x-ray therapy for puerperal mastitis, sweat gland abscesses in the axilla, and furunculi of the face. The conditions of irradiation, as well as the single and total doses, are briefly discussed. Various means of reducing gonad dose are discussed in detail. (auth)

2664

INFLUENCING THE RADIATION REACTION OF VICIA FABA BY RIBITYL BENZOL. H.-J. Maurer and A. Schreiber (Univ. of Bern). Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 596-601(1958) Nov. (In German)

Investigations on the protective effect of ribityl benzol, a probable product of the radiolysis of riboflavin (vitamin B_2), during irradiation of Vicia faba are reported. Ribityl benzol causes a general reduction of metabolism, as measured by the daily root growth. The metabolism reduction is dependent on the duration of the ribityl benzol action. The effect of irradiation on root growth is decreased a statistically significant amount by ribityl benzol. This reduction is not dependent on duration of its action. Respiration with N_2 before and during irradiation improves the protective effect of ribityl benzol only in beans treated for a long period. The possible mechanisms are discussed. (auth)

2665

TREATMENT OF MOUSE LYMPHOSARCOMA BY TOTAL-BODY IRRADIATION AND BY INJECTION OF BONE MARROW AND LYMPH-NODE CELLS. M. J. de Vries and O. Vos (National Health Research Council TNO and National Defense Research Council TNO, Rijswijk Z. H., Netherlands). J. Natl. Cancer Inst. 21, 1117-29(1958) Dec.

The lymphosarcoma could not be eliminated by total-body x irradiation with a supralethal dose. This is in accordance with the experience of other workers who treated transplantable tumors in animals by total-body irradiation. Injection of homologous or heterologous lymph-node cells in addition to bone marrow resulted in inhibition of tumor growth. However, the animals ultimately died either of lymphosarcoma or foreign bone-marrow reaction. It has been shown that antibodies produced by homologous or heterologous lymph-node cells probably play a major part in the inhibition of tumor growth. On the other hand, the debilitating effect of the foreign bone-marrow reaction cannot be excluded with certainty as a factor in the inhibition of tumor growth. The best results with respect to the survival of the animals were obtained after the injection of large numbers of isologous lymph-node cells. In the latter case, the inhibition of lymphosarcoma growth probably is a consequence of competitive proliferation of normal and irradiated neoplastic lymphoid cells in the irradiated host. In these experiments competitive proliferation could not be demonstrated after injection of large numbers of homologous lymph-node cells since this procedure is acutely lethal to mice. (auth)

2666

RADIOSENSITIVITY OF WHITE RATS AFTER CLINICAL RECOVERY FROM ACUTE RADIATION SICKNESS. V. B. Rosen (Sechenov Moscow Inst. of Medicine). Med. Radiol. No. 5, 3-7(1958) Sept.-Oct. (In Russian)

In 2 weeks after the clinical recovery of rats from radiation sickness (appearing as a result of irradiation by the dose of 150 r) there was an increase of resistance of the animals to repeated x-ray irradiation by the same dose, to the absolutely lethal dose (650 r), as well as to the effect of the absolutely lethal dose of diphtheritic toxin and morphine. However, contrary changes were revealed in repeated x-ray irradiation of the majority of rats 2 weeks after their recovery from the radiation sickness induced by the primary dose of 450 r. Only in a few cases the resistance of rats to repeated irradiation with the same dose was increased after the first irradiation with the dose of 450 r. The second irradiation (150 r and 450 r) decreased the resistance of the animals to the third irradiation by the same dose. This work demonstrated that the differences in the reactivity of the animals at the moment of repeated irradiation may be connected with the changed activity of the hypophyseal-adrenal system. (tr-auth)

2667

CHANGE OF EXTERNAL RESPIRATION IN GENERAL IRRADIATION BY PENETRATING RADIATION. E. M. Rabinovich (Central Research Inst. of Roentgen-Radiology, Ministry of Health, USSR). Med. Radiol. No. 5, 7-11(1958) Sept.-Oct. (In Russian)

General x-ray irradiation causes depression of external respiration, which is manifested on the roentgenokymogram by decrease of the frequency of respiration. Normal respiratory rhythm is re-established in 24 hours after the irradiation is discontinued. General irradiation by radioactive cobalt increases the frequency of respiration for a short time, which is rapidly replaced by its acute retardation. This is shown on roentgenokymograms by pronounced decrease in the frequency of respiration with simultaneous increase of the amplitude of individual respiratory periods. Increased single and total doses of penetrating irradiation brings about pronounced changes in the function of external respiration of the animal. Not only the rarefaction of the rhythm is registered in these cases on roentgenograms, but also the change of regularity in alternation of separate respiratory periods, which become irregular. Preferential irradiation of the head by radioactive cobalt causes pronounced stable disturbance of the function of external respiration. (tr-auth)

2668

THE EFFECT OF IONIZING RADIATION ON THE FUNCTIONAL CONDITION OF THE RESPIRATORY

CENTER IN RABBITS. L. G. Terekhova (Inst. of Experimental Medicine, Academy of Medical Sciences, USSR). Med. Radiol. No. 5, 11-14(1958) Sept.-Oct. (In Russian)

This work was devoted to the study of the effect of general x-ray irradiation on the course of anaphylaxis. The condition of the respiratory center was studied in rabbits (irradiated before and after the sensitization) in local and general action of specific serum. (tr-auth)

2669

CHEMICAL PROTECTION OF ANIMALS FROM THE EFFECT OF X RAYS. V. G. Yakovlev and I. L. Ivanov. Med. Radiol. No. 5, 14-20(1958) Sept.-Oct. (In Russian)

Radioprotective effects of various doses of cysteine and cyanide were studied. These drugs were administered to mice, rats, rabbits and dogs by various methods previous to irradiation with lethal doses of filtered x rays. The purity of the preparation has a direct influence on the efficacy of protection of rats with cysteine. This effect of cysteine on rodents is considerably potentiated by the addition of sodium cyanide in a definite proportion. The protection, as well as the reaction of animals to the drugs referred to above depends to a great extent on the species of the animals. The greatest percentage of survival was found in rats, much lower in case of mice, rabbits and dogs. The presence of visible side-effects caused by the large doses of cysteine are mainly noted among the highly organized animals. The number of leukocytes in the blood was sharply reduced during the first few days following the irradiation in rats surviving as a result of protection with cysteine and cyanide. However, the number of leukocytes returned to normal values in 30 days. (tr-auth)

2670

PROTEIN METABOLISM IN THE NUCLEI OF TISSUE CELLS OF RATS IN ACUTE RADIATION SICKNESS. L. I. Il'ina. Med. Radiol. No. 5, 20-4(1958) Sept.-Oct. (In Russian)

Effects of x-ray irradiation on the quantitative content of nuclear proteins and on incorporation of S^{35} methionine into these proteins was studied. The following changes take place in the nuclei of hepatic cells and the mucous membrane of small intestine of irradiated rats in acute radiation sickness: the content of desoxyribonucleoproteid decreases, while the quantity of acid and "residual" proteins is increased. The level of S^{35} methionine incorporation into the nuclear proteins also shows a rise. (tr-auth)

2671

CHANGES IN THE PHYSICOCHEMICAL PROPERTIES OF DNA OF THE TISSUE IN IRRADIATED ANIMALS. G. P. Toropova and N. V. Ermolaeva. Med. Radiol. No. 5, 24-9(1958) Sept.-Oct. (In Russian)

Studies were made of the physicochemical properties of highly polymeric preparations of desoxyribonucleic acid recovered from the isolated nuclei from the wall of the small intestine and liver tissue at various periods after irradiation of rabbits by a lethal x ray doses (1000 r). The ratio of nitrogen to phosphorus and pentose in the DNA preparations obtained from the tissues of control animals was equal to the theoretical value. Decrease of nitrogen in the DNA molecule was noted in 3 hours after irradiation. The ratio between the nitrogen and the phosphorus was decreased to 1.47 for DNA of the intestinal wall and to 1.37 for the liver tissue. Simultaneously with the change of the chemical content the decrease of viscosity and the change of the absorption spectra took place. These changes were more significant in the liver tissue than in the intestinal wall. The physiological properties of DNA, isolated from the intestinal wall were re-established in 24 hours. Properties were not re-established even in 3 days in the DNA from liver tissue. (L.M.T.)

2672

THE PROPERTIES OF HIGHLY POLYMERIC DNA OF LIVER IN RADIATION INJURIES CAUSED BY POLONIUM. M. S. Uspenskaya. Med. Radiol. No. 5, 30-7 (1958) Sept.-Oct. (In Russian)

It was revealed that there is a decrease of the structural viscosity of DNA in the liver of rats in 24 hours and 3 days following the administration of polonium. On the 9th day the degree of DNA polymerism was above the normal. In the majority of cases depolymerization of DNA occurred in the terminal stages of radiation sickness. The content of DNA was decreased in 24 hours after the administration of polonium. The quantity of nitrogen gradually increased in the preparations of DNA isolated during the development of radiation sickness, but returned to normal at the terminal period of the disease. Insignificant reduction in the content of phosphorus was noted in the preparations of highly polymeric DNA on the 3rd day and during the terminal stages of radiation sickness. Chemical and physicochemical changes in the DNA of the liver in radiation sickness of rats caused by the action of incorporated polonium serves as an indication of the change of specific structure of the native molecule of DNA. It is an important factor in disturbance of the normal metabolism of the living cell. (tr-auth)

2673

DATA ON THE TOXICOLOGY OF RADIOACTIVE RUTHENIUM IN ADMINISTRATION VIA THE ALIMENTARY TRACT. V. N. Streltsova and L. A. Buldakov. Med. Radiol. No. 5, 37-50(1958) Sept.-Oct. (In Russian)

The clinical picture of radiation injuries in rats caused by single peroral introduction of Ru^{106} and continuous daily introduction (for 100 days) in quantities of 800, 160, and 16, and 1.6 μc was studied. (R.V.J.)

2674

THE EFFECT OF COMPLEX PRODUCERS ON THE EXCRETION OF RADIOACTIVE ISOTOPES (STRONTIUM, YTTRIUM AND CERIUM). Yu. I. Moskalev and L. N. Budko. Med. Radiol. No. 5, 50-8(1958) Sept.-Oct. (In Russian)

A comparative analysis of the effect of hexametaphosphate, sulphasalycilic, aurine ticarbonic and ethylene diamintetraacetic acids, yatren, atophan and euphylline on the distribution of $Sr^{89,90}$, Y^{91} and Ce^{144} is presented. As compared to other complex producers hexametaphosphate and sulphosalycilic acid appeared to be the most effective. They decrease the content of Y and Ce in the organs of animals and, which is most important, they also diminish the amount of Sr. In case of Y ethylene cyaminetetra-acetate appeared to be the most effective. The efficacy of complex producers depends on the method of administration of the isotopes. If an isotope enters the bloodflow slowly (resorption from a depot) the efficacy of complex producers is intensified. There was a difference in the action of complex producers on the distribution of elements similar by their chemical properties (Ce and Y). The results obtained in case of one radioactive element cannot be mechanically applied to another one. (tr-auth)

2675

CERTAIN DATA CONCERNING THE EFFECT OF IRRADIATION ON HAEMOPOIESIS OF SPLENECTOMIZED RATS. Yu. V. Venitskovskii-Zolotikh. Med. Radiol. No. 5, 58-64(1958) Sept.-Oct. (In Russian)

An attempt was made to find out the influence of the spleen on bone marrow after general irradiation of animals by x ray. One group of white rats was splenectomized 1½ months before irradiation, which was performed with the aid of RUM-3 apparatus. The dose of irradiation was 400 r which is the lethal dose for rats in 50 to 30 days. The animals were subjected to haemotological examination before splenectomy, before irradiation and on the 4th, 11th and 20th day after irradiation. The number of leukocytes, erythrocytes, thrombocytes and reticulocytes was determined and differential count of leukocytes made. It was revealed by this experiment that lymphocytosis and eosinophilia (in majority of cases) is developed in rats in remote time-limits after splenectomy. In all other respects their blood remained normal. Examinations of peripheral blood and bone marrow show the influence of the spleen on the bone marrow of irradiated rats. These experiments reveal that spleen has a retarding effect on all forms of haemopoieses in the bone marrow. The mechanism of this action is not specific for radiation sickness. (tr-auth)

2676

THE EFFECT OF IONIZING RADIATION IN LARGE DOSES ON THE RABBIT'S AND HORSE'S BLOOD SERUMS (PHYSICO-CHEMICAL INVESTIGATION). V. M. Vadimov (Gamalei Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, USSR). Med. Radiol. No. 5, 64-8(1958) Sept.-Oct. (In Russian)

The rabbit's and horse's blood serums were subjected to ionizing radiation in large doses (up to 2.000,000 r). These experiments demonstrated that the differences between various serum globulin fractions disappear as a result of protein disintegration (the method of electrophoresis on paper was employed). However, the difference between albumins and globulins is preserved (with certain changes). The coefficient of absorption in the ultraviolet portion of the spectrum is increased in serums irradiated by x rays, which points to the presence of denatured protein. (tr-auth)

2677

THE EFFECT OF GAMMA RAYS ON THE CAPSULES OF FRIEDLANDER'S BACILLI. G. M. Lvitsyna. Med. Radiol. No. 5, 68-71(1958) Sept.-Oct. (In Russian)

Studies were made of the action of massive doses of gamma rays on modification of the morphological properties of the capsule in a typical strain of Friedlander's bacilli. The change of the size of the capsules was observed in smears prepared by the Burri-Gin's method. The external appearance of the irradiated cultures was studied also. It was demonstrated that irradiation of the 24-hour culture of Friedlander's bacillus with the dose of 600,000 r produces a significant decrease in the size of microbic cell and of its capsule. Irradiation by gamma rays in the doses of 600,000 r and 200,000 r resulted in the change of external appearance of Friedlander's bacilli in the agar and broth cultures, liquefaction and the loss of viscosity of the agar cultures, disappearance of the membrane and complete clearance of the broth. (tr-auth)

2678

MORPHOLOGICAL CHARACTERISTICS OF THE PROCESS OF WOUND HEALING IN RADIATION SICKNESS. V. V. Bystrova and S. S. Sokolov. Med. Radiol. No. 5, 71-7(1958) Sept.-Oct. (In Russian)

2679

HISTOCHEMICAL RESEARCH ON IRON EXCHANGE IN HEMATOPOIETIC ORGANS IN ACUTE RADIATION SICKNESS DUE TO RADIOACTIVE PHOSPHORUS. F. I. Shcherban. Med. Radiol. No. 5, 78-82(1958) Sept.-Oct. (In Russian)

Results of histochemical research on iron exchange showed a strong increase of the trivalent inorganic iron in the hematopoietic organ reticulo-endothelium which was accompanied by sharp decrease of organic iron in the bone marrow, in follicles, in the red pulp of spleen, and in the lymph nodes. The original intercellular distribution of iron was replaced by extracellular, which indicates the functional deficiency of the reticulo-endothelium in radiation sickness. (R.V.J.)

2680

THE MORPHOLOGY OF DEATH DURING IRRADIATION AND AFTER IT. L. V. Funshtein and P. V. Sipovskii. Med. Radiol. No. 5, 82-4(1958) Sept.-Oct. (In Russian)

The pathological physiology of radiation injury during irradiation and at various times following the exposure was investigated. (R.V.J.)

2681

BLOOD TRANSFUSION IN COMBATTING RADIATION LEUKOPENIA. K. N. Chochia, E. M. Shvartzberg, and F. Ya. Stolyar. Med. Radiol. No. 5, 84-90(1958) Sept.-Oct. (In Russian)

Data were compiled from clinical materials, including 87 cases with malignant neoplasms subjected to radiation therapy. The tables presented in this article show that there is a change in the number of leukocytes in the peripheral blood under the effect of ionizing radiation in the majority of patients, (the presence of leukopenia with regrouping of the neutrophils and lymphocytes in the opposite direction with a relative and absolute lymphopenia). Repeated blood transfusions in the doses of 100 to 150 cc improve the general condition of the patients and maintain the r. b. c. on the same level during the whole course of treatment. It also causes moderate changes in the total number of leukocytes towards their increase and regrouping of neutrophils and lymphocytes with a tendency to normalization. (tr-auth)

2682

THE CONTENT OF URIC ACID AND ALLANTOIN IN THE URINE OF RATS SUBJECTED TO X RAY IRRADIATION. T. A. Fedorova and P. M. Babarin. Med. Radiol. No. 5, 90-4(1958) Sept.-Oct. (In Russian)

A sharp drop of uric acid in the urine of irradiated rats begins on the second day after exposure, and a considerable increase of allantoin (~ 26%) was observed the next day after the exposure. (R.V.J.)

2683

ALTERATION OF HOMOGRAFT REACTION BY A-METHOPTERIN IN LETHALLY IRRADIATED MICE TREATED WITH HOMOLOGOUS MARROW. Delta E. Uphoff (National Cancer Inst., Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 99, 651-3(1958) Dec.

Mice which would normally succumb to a homograft reaction following lethal, total-body x irradiation and homologous marrow inoculation, may be spared if they are treated with folic acid antagonist, A-methopterin. Using different treatment schedules, varying degrees of effectiveness from increased survival following a typical reaction, to no detectable reaction, may be ob-

tained. The relationship between drug toxicity and effectiveness in altering the homograft reaction is discussed. (auth)

2684

GENETIC DIFFERENCES IN HEMOGLOBIN AS MARKERS FOR BONE MARROW TRANSPLANTATION IN MICE. Raymond A. Popp, G. E. Cosgrove, Jr., and R. D. Owen (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 99, 692-4(1958) Dec.

Both hemoglobin type and red cell serotype seem to be autonomously controlled by the genotype of the nucleated cell from which the erythrocyte is derived. Thus, genetic differences in hemoglobin can be used as markers for bone marrow transplantation in irradiated mice. Hemoglobin typing may be particularly useful where the H-2 markers cannot be used. (auth)

2685

COMPARATIVE EFFECTIVENESS OF FRESH AND LYOPHILIZED PLATELETS IN CONTROLLING IRRADIATION HEMORRHAGE IN THE RAT. T. M. Fliedner, D. K. Sorensen, V. P. Bond, E. P. Cronkite, D. P. Jackson, and E. Adamik (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 99, 731-3 (1958) Dec.

The efficiency of fresh vs. lyophilized platelet transfusions to control radiation-induced hemorrhage were tested in rats by gross observation for bleeding, platelet count, hematocrit, microscopical study of lymph node sections, and susceptibility to bleeding from minor trauma. Hemorrhage occurs in irradiated, untreated rats around the fifth post irradiation day increasing with the progress of platelet fall, which reach a minimum around the tenth day. Fresh and lyophilized platelet transfusions were performed on 5th, 7th and 9th day. Whereas fresh platelet transfusions raised the platelet count to 2 to 3 times the normal and stopped hemorrhage, lyophilized material had no effect on platelet counts which were not different from irradiated controls and did not show any influence on the bleeding tendency. In the lyophilized platelet transfused rats, the hematocrit dropped more than in the irradiated controls. (auth)

2686

EFFECT OF PROPERDIN ON WHOLE BODY IRRADIATED MICE AND RATS. Fred Miya, Stanley Marcus, and Bert D. Thorpe (Univ. of Utah, Salt Lake City). Proc. Soc. Exptl. Biol. Med. 99, 757-61(1958) Dec.

Under conditions employed, postirradiation treatment of mice and rats with partially purified bovine properdin and purified human properdin administered intraperitoneally or intravenously did not afford protection against the effects of whole-body x irradiation. There appeared to be a relationship between delayed mortality and time of injection. (auth)

2687

THE EARLY GASTROINTESTINAL RESPONSE IN THE RAT EXPOSED TO WHOLE-BODY X-IRRADIATION. D. G. Baker and C. G. Hunter (Univ. of Toronto). Radiation Research 9, 660-6(1958) Dec.

Fasting rats were exposed to whole-body x irradiation at doses of 100, 300, 500, and 700 r. Immediately prior to fasting, charcoal was incorporated into the diet in order to locate the food along the intestinal tract. During the first 5 hours post-irradiation, the weight of the stomach contents in all groups increased. At the same time the movement of the carbon particles indicated that there was an antiperistalsis in the small intestine that caused the intestinal contents to be regurgitated into the stomach. An analogy between this response and the radiation sickness in human subjects is made, and a hypothesis accounting for this is proposed. (auth)

2688

THE EFFECT OF SURROUNDING TEMPERATURE ON THE COURSE OF RADIATION SICKNESS. L. N. Mushina-Udgodskaya (Central Inst. of Post-Graduate Medicine). Vestnik Rentgenol. i Radiol. 33, No. 3, 23-7(1958) May-June. (In Russian)

Acute radiation sickness was experimentally induced in white rats. A considerable effect of temperature of the surrounding environment (air) on the severity of this disease was noted. The mortality of rats equalled 95% when the air temperature was 20-25°C (in summer). When rats were irradiated by the same doses during the winter season at the temperature of 8 to 10°C (in vivarium) their mortality reduced to 5%. The unfavorable effect of high temperature was mostly manifested in increased mortality of irradiated rats. This factor also affected (but to a lesser extent) the clinical manifestations of radiation sickness the morphology of a number of organs and the blood picture. (tr-auth)

2689

PECULIARITIES IN THE COURSE OF CLOSED FRACTURES WITH SIMULTANEOUS PROLONGED CONTUSION IN CONDITION OF RADIATION SICKNESS. U. I. Kazhlaeva (State Research Inst. in Roentgenology and Radiology). Vestnik Rentgenol. i Radiol. 33, No. 3, 27-32(1958) May-June. (In Russian)

Experiments with 74 rabbits showed that the course and healing of fractures in radiation sickness were changed. Healing of fractures was retarded by 7 to 10 days. The process of consolidation of the callus was slower than in the usual conditions, which was shown roentgenologically in cases with correct reposition of bone fragments. The clinical course of closed fractures in combined affections is more severe than in the usual conditions. The prolonged contusion of the soft tissues in the place of fracture makes the course of closed fractures worse and retards the callus formation. The course of radiation sickness is also more severe. This condition may change the surgical tactics of treatment of fractures in people with radiation sickness due to penetrating radiation. (tr-auth)

2690

LESIONS OF THE TEETH AND NECROSIS OF THE MANDIBLE AS A COMPLICATION OF RADIATION THERAPY OF CANCER ON THE ORAL CAVITY. K. N. Chochia and K. B. Shimanovskaya (Central Research Inst. of Roentgenology and Radiology, Ministry of Health, USSR). Vestnik Rentgenol. i Radiol. 33, No. 3, 32-7(1958) May-June. (In Russian)

The authors studied 265 case histories of patients subjected to radiation treatment during the period covering the years of 1945 to 1955. This included 201 cases of cancer of the lower lip, 49 cancer of the tongue, and 15 cancer of the mucous membrane of the cheek. Almost all the patients noted dryness of the mouth for 3 to 4 months. The teeth gradually became somewhat dull and aquired a grayish or blackish tint. In many cases they showed a gradual decomposition. Necrosis of the mandible developed in 6 patients, 8 months to 8 years following the treatment. In development of necrosis the total dose is not as important as repeated irradiations with comparatively short intervals. An

overdose in introduction of needles into the tissue, the close location of these needles to the alveolar edge of the jaws, the presence of pyorrhea and carious teeth (as a source of infection), trauma of the jaw (due to extraction of teeth) are even of greater significance during irradiation. (tr-auth)

2691

PROPHYLAXIS AND TREATMENT OF SKIN INJURIES IN RADIATION THERAPY OF PATIENTS WITH MALIGNANT NEOPLASMS. N. P. Mordvinova, B. K. Rostotskii, and Ya. A. Aleshkina (State Scientific Research Inst. of Roentgenology and Radiology, Ministry of Health, USSR). Vestnik Rentgenol. i Radiol. 33, No. 3, 37-40(1958) May-June. (In Russian)

A new preparation was suggested for prevention of radiation injuries of the skin—an emulsion of aloe juice (VILAR) which was tried on 200 patients, 180 of whom were subjected to radiotherapy in connection with malignant neoplasms. When this emulsion is employed the dose of ionizing radiation on the skin field may be increased by 1000 r in any location of the tumor in comparison with the control group. The skin reaction (if it appears) is milder and the recovery is quicker. The emulsion was successfully used in treatment of ulcers appearing on the skin as a result of irradiation connected with malignant tumors. Aloe emulsion gave favorable results in treatment of hands of personnel working with ionizing radiation for a long time. (tr-auth)

2692

DOSIMETRY IN IRRADIATION OF THE HUMAN HEAD BY GAMMA RAYS. E. V. Utekhin (Central Research Inst. of Roentgenology and Radiology, Ministry of Health, USSR). Vestnik Rentgenol. i Radiol. 33, No. 3, 48-52(1958) May-June. (In Russian)

Two methods were employed in irradiation of the hypophyseal area: external irradiation and irradiation by administration of Co^{60} preparations into the nasopharynx. Dosimetry of gamma-irradiation was determined in both methods of irradiation. The study of the doses in internal irradiation was carried out on a phantom human head on the head of a cadaver. The dose which was received by the hypophysis in external irradiation from the gamma apparatus was compared with that received by the patient from the radioactive preparations administered into the nasopharynx. The first method was found to be better than the second one. In the first method the hypophyseal area receives only 2% of the dose received by the soft tissues surrounding the radioactive preparation, while in the second method 40% of the dose on the surface of the head reaches the hypophysis, the skin focal distance being 25 cm. (tr-auth)

2693

ON THE MATHEMATICAL ANALYSIS OF RADIATION INACTIVATION OF MICROBIOLOGIC OBJECTS OF DIFFERENT PLOIDY GRADES WITH CONSIDERATION OF GENETIC AND NON-GENETIC CONSTITUENTS. Werner Stein and Wolfgang Laskowski (Freien Univ., Berlin and Max-Planck-Inst., Berlin-Dahlem). Z. Naturforsch. 13b, 651-7(1958) Oct. (In German)

For the interpretation of radiation induced inactivations of microorganisms, a multi-target model is frequently used which assumes at least implicitly that only recessive lethal mutations are responsible for the effect. This model is criticized first because it disregards certain existent dominant lethal mutations as well as cytoplasmic effects and secondly because it employs a highly specialized formula. Proposals are made for the use of a more complete and less specialized formula. The observed crossing of dose-effect-curves of haploid and diploid yeast strains can be explained by this mathematical theory. The importance of the use of endomitotically originated strains of different ploidy and complete homozygous constitution is emphasized. Such strains are available in Saccharomyces. (auth)

2694

RADIOACTIVE ISOTOPES IN BIOCHEMISTRY. Engelbert Broda. Vienna, Franz Deuticke, 1958. 333p. (In German)

The application of radioisotopes to the problems of biochemistry is discussed in detail. The first half of the book deals with the general principles and methods. Radioelements for biochemistry, basis for radiochemistry, radiosynthesis, isotope effects, radiation chemistry, radiation biology and radiation protection, the measurement of radioactivity, application of radioactivity to the analysis of living substances, and absorption and elimination of elements by plant and animals are the subjects discussed in this section. The last part of the book deals with the principal problems of intermediary metabolism. The application of radioisotopes to the investigation of photosynthesis, carbohydrate decomposition, formation of amino acids by cells and tissues, formation of nucleic acids, and related subjects are discussed in this section, and examples are given. (J.S.R.)

CHEMISTRY

General

2695 AD-157156

Stockholm. Univ. Inst. of Inorganic and Physical Chemistry.

STUDIES ON THE CRYSTAL CHEMISTRY OF TITANIUM, VANADIUM AND ZIRCONIUM OXIDES AT ELEVATED TEMPERATURES. Final Technical Report No. 1 Covering Period October 1, 1957—September 30, 1958. Arne Magnéli, Sten Andersson, Stig Åsbrink, Sven Westman, and Bo Holmberg. Oct. 1958. 97p. Contract DA-91-508-EUC-245.

The crystal chemistry of the titanium—oxygen and vanadium—oxygen systems was studied by means of x-ray methods for compositions $TiO_{0.1-2.0}$ and $VO_{0.5-2.0}$ and temperatures ranging from room temperature upwards. A study was also made of the zirconium—oxygen system for oxygen contents up to $ZrO_{0.5}$. Three phases exist within the solubility range of oxygen in α-titanium, viz. TiO_{0+x}, Ti_2O_{1-y}, and $Ti_2O_{1-\frac{1}{2}}$, corresponding to random, partly ordered and ordered states, respectively. The degree of order depends on the composition and temperature. The structure of Ti_2O_{1-y} at the ordered, limiting composition Ti_2O is of the anti-$Cd(OH)_2$ type. Solid solutions of oxygen in α-zirconium also comprise random and ordered states. The crystal structure of the so-called δ-titanium oxide has been determined. The structure is related to that of the ω-phases of several binary alloy systems containing titanium. The high-temperature titanium and vanadium monoxides of random, defective NaCl-type may decompose upon heat-treatment to give compounds of compositions close to $TiO_{1.00}$ and $VO_{0.8}$ and $VO_{1.2}$, respec-

tively. The x-ray evidence indicates that these phases are structurally related and are of defective, distorted NaCl-type with ordered atomic vacancies. The atomic coordinates of Ti_2O_3 and V_2O_3 at room temperature were determined. Ti_3O_5 shows a rapid, reversible phase transformation at 100°C. The structure of the low-temperature modification was determined. A characteristic feature of this structure is the occurrence of very short Ti-Ti distances, indicating bonding between the motal atoms. The bonds are broken during the transformation to the high-temperature modification. The latter is of a deformed pseudobrookite type. It may be stabilized at room temperature by replacing a small proportion of the titanium content with iron. The structure of V_3O_5 was determined and found to be entirely different from those of the two Ti_3O_5 modifications. A crystal structure determination has been performed on Ti_5O_9, the second member of the homologous series Ti_nO_{2n-1}. The structure may be described in terms of slabs of rutile-type structure having an infinite extension in two dimensions. The slabs are mutually connected by TiO_6 octahedra sharing faces (edges in rutile). The building principle of this structure should be the one present in all the members of the homologous series Ti_nO_{2n-1} and V_nO_{2n-1}, the thickness of the slabs determining the value of n. When heated to 70°C, VO_2 of MoO_2-type structure undergoes a rapid, reversible transformation to a structure essentially of the rutile type. The phase transition involves a considerable change in the chemical bonding. Data for several oxide phases are given, e.g., coefficients of thermal expansion and limits of homogeneity ranges. (auth)

2696 AECU-3896

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

DESIGN OF A ONCE-THROUGH RUBIDIUM BOILER. Stephen F. D'Urso and Victor C. Vaughen. Nov. 27, 1956. 16p. For Union Carbide Nuclear Co. K-25 Plant. Contract W-7405-eng-26, Subcontract 70. (KT-245). $3.30(ph OTS); $2.40(mf OTS).

The design of an apparatus for the measurement of heat-transfer coefficients of boiling Rb at 1530°F and 50 psi is presented. (W.L.H.)

2697 AECU-3899

Anderson Physical Lab., Champaign, Ill.

PROGRESS REPORT [FOR] SEPTEMBER 1958. Technical Report No. 5. 13p. Contract AT(11-1)-544. $3.30(ph OTS); $2.40(mf OTS).

The analytical work has continued to be centered largely on the cathode layer spectrographic method. Increasing attention has been given to the hollow cathode method. Some work in the field of ion exchange has been carried out. After the last run produced such a good crystal from the impurity standpoint, it was decided to attempt a zone refinement of KCl on a large scale. The construction of the Kyropoulas crystal grower is reported. (W.L.H.)

2698 AECU-3928

Michigan State Univ., East Lansing.

KINETICS OF FORMATION AND ISOTOPE EXCHANGE REACTIONS INVOLVING THE CHLORINE FLUORIDES. I. KINETICS OF THE FORMATION OF CHLORINE MONOFLUORIDE FROM CHLORINE AND CHLORINE TRIFLUORIDE. II. KINETICS OF THE EXCHANGE OF CHLORINE BETWEEN CHLORINE MONOFLUORIDE AND CHLORINE TRIFLUORIDE. III. KINETICS OF THE EXCHANGE OF CHLORINE BETWEEN CHLORINE MONOFLUORIDE AND CHLORINE. Max T. Rogers, James C. Sternberg, and James P. Phelps. Mar. 1956. 156p. Contract AT-(11-1)-151. (M-5881). $24.30(ph OTS); $7.50(mf OTS).

The systems chlorine trifluoride—chlorine, chlorine trifluoride—chlorine monofluoride, and chlorine monofluoride—chlorine were studied to determine isotopic chlorine exchange in the gas phase. The chemical reaction kinetics of the system chlorine trifluoride—chlorine were studied. Special equipment suitable for studying gaseous reactions of halogen fluorides was designed and constructed, including equipment for the study of isotope exchange in which a radioactive isotope is utilized. (W.L.H.)

2699 AECU-3939

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

VISUAL OBSERVATION OF LIQUID-LIQUID SPRAY COLUMN PERFORMANCE. M. H. Fontana and R. W. Wolff. Nov. 27, 1956. 31p. For [Oak Ridge Gaseous Diffusion Plant. Contract W-7405-eng-26, Subcontract 70]. (KT-250). $6.30(ph OTS); $3.00(mf OTS).

The degree and type of mixing in a two-phase spray column can be studied visually. In this investigation various types of spray column packings and bafflings were observed by this method. The effect of back mixing was also determined by means of the residence time technique. The main criteria to be observed in this study were: The relative size of the droplets of the discontinuous phase; size, shape, and behavior of eddies of the continuous phase; column holdup of the discontinuous phase, maximum discontinuous phase flooding rate for various packing geometries and continuous phase flows. Desirable qualities were considered to be: small discontinuous phase droplets, small eddies of the continuous phase that would create high interfacial turbulence of the two phases, absence of large recirculations of the phases, and a high throughput. Moving pictures were taken of the column operating under various conditions. A brief tabulation of all motion picture views is given. (auth)

2700 AERE-C/M-361

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF TEMPERATURE ON THE CARBON DIOXIDE—GRAPHITE REACTION UNDER PILE RADIATION. H. B. F. Gow and W. R. Marsh. Nov. 1958. 14p.

The rate of the reaction between carbon dioxide and graphite under the influence of pile radiation was studied at 350 and 500°C. No significant difference was observed in the rate of the reaction at these two temperatures. (auth)

2701 AGARD-178

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

ELASTOMERS FOR HIGH TEMPERATURE APPLICATIONS. E. R. Bartholomew. [1958]. 30p.

Presented at the Seventh Meeting of the Structures and Materials Panel, Mar. 24, to Apr. 3, 1958, Rome.

A review is given of the source and nature of high-temperature elastomer problems, and the limitations of the more conventional elastomer materials are discussed. Recent data on properties of special high-temperature polymers and their compounds are included. (A.C.)

2702 BNL-3881

Brookhaven National Lab., Upton, N. Y.

THE EFFECT OF ION PAIRING ON THE KINETICS OF EXCHANGE OF p-NITROBENZYL BROMIDE WITH RADIOBROMIDE IN LIQUID SO_2. K. N. Rao and N. N. Lichtin. [1958]. 3p. $1.80(ph OTS); $1.80(mf OTS).

An investigation was made of the effect of ion pairing on the kinetics of exchange of p-nitrobenzyl bromide with radiobromide in liquid sulfur dioxide solutions at various concentrations. The use of conductance data for ionphores was found effective as a means of discriminating between ions which are free and ions which are paired, insofar as their chemical reactivities are concerned. Both conductance data and kinetics data indicate the presence of two states of the bromide ion and agree as to the relative amounts of each which are present. The data also suggest that the kinetic reactivity of a paired ion increases with decrease in the free energy of dissociation. (C.H.)

2703 CF-58-9-35

Oak Ridge National Lab., Tenn.

HRP—PRELIMINARY STUDIES OF THE FLUIDIZED BED DENITRATION OF THORIUM NITRATE. Harvey L. List. Sept. 30, 1958. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Equipment for an exploratory study of the denitration of thorium nitrate in a fluidized bed was designed and constructed. Some operating difficulties were resolved and a successful initial run was made. (auth)

2704 CF-58-11-31

Oak Ridge National Lab., Tenn.

EXPLOSIVE REACTIONS DURING REPROCESSING OF REACTOR FUELS CONTAINING URANIUM AND ZIRCONIUM OR NIOBIUM. T. A. Gens. Nov. 13, 1958. 11p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40 (mf OTS).

Small particles of zirconium formed during mechanical operations have caused serious industrial explosions. Particles of this type will not be encountered during aqueous chemical reprocessing. However, small particles of metallic phases rich in zirconium or niobium, produced by selective leaching of a more reactive uranium-rich phase, can enter into violently explosive reactions. The conditions under which explosions with zirconium-bearing alloys may be expected during chemical reprocessing have been defined in the literature. The uranium—zirconium alloys containing less than 30 wt. % zirconium are hazardous when they contact nitric acid. Laboratory work has shown that potentially explosive zirconium alloys may be safely dissolved in nitric acid if enough fluoride ion is added to maintain a mole ratio of fluoride to dissolved zirconium of four. Niobium-bearing fuel alloys can also explode after contacting nitric acid, but the conditions which produce explosions have not yet been studied thoroughly. Dissolution studies with the EBWR alloy (93.5% U, 5% Zr, 1.5% Nb) indicate that hazardous niobium alloys can also be processed safely in nitric acid by addition of enough fluoride to prevent formation of surface deposits. The ternary phase diagram for zirconium—uranium—oxygen shows that the epsilon phase is unstable at the interface between a zirconium or a Zircaloy-2 cladding and a uranium oxide core. These fuels can be processed by techniques which require contact with nitric acid without fear of epsilon-phase explosions. (auth)

2705 HW-57400

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRELIMINARY INVESTIGATION OF ISOPROPYLATED TERPHENYL-A POTENTIAL REACTOR COOLANT. D. R. de Halas. Sept. 9, 1958. 12p. Contract W-31-109-eng-52. $0.50(OTS).

Some preliminary investigations of the physical properties and the pyrolitic and radiolytic stability of an isopropylated mixture of ortho- and meta-terphenyls are presented. (W.L.H.)

2706 HW-57873

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE USE OF ANION EXCHANGE IN THE SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN PLUTONIUM. R. Ko. Oct. 20, 1958. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Impurity concentrations of aluminum, calcium, chromium, iron, magnesium, manganese, nickel, and zinc in plutonium were determined by an anion exchange-spectrographic method. Plutonium was separated by adsorption of the nitrate complex on Dowex 1. The impurities were determined in the effluent by DC arc excitation with cobalt as the internal standard. Concentrations as low as two parts of impurity per million parts of plutonium (ppm) in 50 mg samples were determined with a precision of ± 12% (95% C. L. for a single measurement). (auth)

2707 IGO-AM/S-13

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF BROMINE IN URANIUM HEXAFLUORIDE. Nov. 11, 1955. 9p.

The uranium hexafluoride is sampled in a silver vessel and hydrolyzed with water, which dissolves or hydrolyzes the bromine compounds. After a reduction with sulfur dioxide, the bromine is precipitated as silver bromide and collected on silver chloride. The bromide is converted to soluble potassium bromide by treatment with potassium hydroxide and hydrogen peroxide. The bromide is oxidized to bromate with sodium hypochlorite, excess of which is destroyed. Reaction of the bromate with excess bromide in acid solution, using a molybdenum catalyst, liberates bromine. This is allowed to react with rosaniline, which has been decolorized with acid. The color of the resulting bromo rosaniline is measured in the presence of tertiary butyl alcohol, using an absorptiometer. (auth)

2708 IGO-AM/S-18

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF TRACES OF URANIUM IN THORIUM METAL. Mar. 14, 1956. 6p.

The uranium is separated from a solution of the metal by means of a column of cellulose powder and a solution of nitric acid in ether. The uranium is determined fluorimetrically. The method is applicable to 0.1 to 10 ppm concentrations. Higher values may be determined by further dilution of the final solution. (auth)

2709 IGO-AM/S-27

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

SPECTROGRAPHIC DETERMINATION OF CALCIUM IN THORIUM AND THORIA USING THE LUNDEGARDH TECHNIQUE. Mar. 8, 1956. 10p.

The sample is dissolved in 50% nitric acid with the

aid of a small amount of dilute hydrofluoric acid. A cobalt internal standard solution is added and the solution spectrographed by the Lundegardh technique using a medium quartz spectrograph. The spectrograms are evaluated by an intensity method. The method is applicable to samples of thorium metal and oxide containing trace impurities other than calcium and aluminum. Calcium concentrations from 50 to 1000 ppm can be determined with a precision of approximately ±13%. (auth)

2710 IGO-AM/S-29

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF IRON IN AMMONIUM DIURANATE AND URANIC LIQUORS. Apr. 6, 1956. 5p.

The ammonium diuranate is dissolved in nitric acid. An aliquot equivalent to 1 g of uranium is treated with sulfamic acid to suppress interference by nitrite, and the thioglycolic iron complex developed in the presence of ammonium carbonate and ammonium citrate is determined absorptiometrically. The method is suitable for the determination of iron concentrations between 0 to 300 ppm. The amount of uranium must, however, not exceed 1.5 g. (auth)

2711 IGO-AM/S-42

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

ANALYTICAL METHOD—THE ABSORPTIOMETRIC DETERMINATION OF NICKEL IN URANIUM METAL. 1958. 7p.

Nickel is extracted as its dimethyl glyoxime complex into chloroform from an alkaline solution of the metal. The chloroform solution is acid extracted, and the nickel in the extract is determined absorptiometrically as the oxidized dimethyl glyoxime complex. (auth)

2712 IGO-AM/S-48

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF CARBON IN URANIUM METAL BY COMBUSTION AND ABSORPTION OF CARBON DIOXIDE. 1958. 7p.

The sample, after cleaning, is ignited in a current of air at a temperature of 1000 to 1050°C, and the carbon dioxide produced is absorbed in soda asbestos and weighed. The method is applicable only to metal in the form of turnings with a carbon content from 50 ppm up to the limit imposed by the capacity of the soda asbestos absorption tube. (auth)

2713 IGO-AM/S-118

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF CALCIUM IN URANIUM METAL. 1958. 7p.

The sample is ignited to U_3O_8 and sparked between copper electrodes. The spectra are recorded in a fully automatic grating spectrograph. A microphotometer is used to obtain comparative galvanometer deflections for the single calcium and the four uranium lines. (auth)

2714 IGO-AM/S-120

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF MOLYBDENUM IN URANIUM METAL. 1958. 5p.

The sample is dissolved in hydrochloric acid and hydrogen peroxide. Molybdenum is then extracted as the thiocyanate complex into a diethyl ether—petroleum ether mixture and determined absorptiometrically. (auth)

2715 IGO-AM/S-121

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF COMBINED NITROGEN IN URANIUM METAL INCLUDING SWARF AND POWDER. June 6, 1958. 9p.

The sample is dissolved in HCl, and the solution is completed by oxidation with perchloric acid, converting the combined nitrogen to ammonium salts. An aliquot of the solution is treated with NaOH and steam distilled. The liberated ammonia is collected and determined absorptiometrically using sodium phenate reagent. (auth)

2716 IGO-AM/S-124

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF BORON IN URANIUM METAL. June 11, 1958. 16p.

The metal is dissolved in HCl and oxidized with HNO_3. The pH is adjusted, and the boron is separated by distillation as methyl borate. The boron is determined absorptiometrically by means of its reaction with curcumin. (auth)

2717 IGO-AM/S-125

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF ALUMINIUM IN URANIUM METAL. 1958. 11p.

The sample is ignited to U_3O_8 and mixed with NaF. Charges of the mixture are excited in a d-c arc, and the NaF distils accompanied by the Al. The arc is aligned with a large quartz spectrograph, and the resultant spectra are evaluated by means of a non-recording microphotometer. (auth)

2718 IGR-TN/C-281

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

THE DECOMPOSITION OF TRICHLORETHYLENE. R. Lind and M. P. McGuinness. 1958. Date of MS. Feb. 6, 1955. 31p. (IGC-CTC/R-154).

Decomposition of alkaline trichloroethylene refluxing under nitrogen took place rapidly on mild steel surfaces but only slowly in the presence of aluminum or cupronickel. Several inhibitors delayed onset of decomposition on mild steel but had little effect on the course of reaction once it had begun. Surface treatment of the steel also delayed but did not prevent onset of reaction. Of methods of treating contaminated plant, the most effective was exposure to hot aqueous sodium carbonate solution. (auth)

2719 ISC-882

Ames Lab., Ames, Iowa.

THE ABSOLUTE ABUNDANCE OF THE NITROGEN ISOTOPES IN THE ATMOSPHERE AND COMPRESSED GAS FROM VARIOUS SOURCES. Gregor Junk and Harry J. Svec. [July 23, 1957]. 21p. Contract [W-7405-eng-82]. $4.80(ph OTS); $2.70(mf OTS).

The absolute abundance of the isotopes in atmospheric and commercial compressed N_2 from various sources has been determined. Nitrogen gas standards, prepared by mixing separated nitrogen isotopes in the form of $(NH_4)_2SO_4$ solutions, were employed to calibrate two 60° sector mass spectrometers. As a result, the absolute ratio of N^{14}/N^{15} in atmospheric nitrogen was found to be 272.0 ± 0.3. Small variations from this value were found for commercial compressed gas. The mass spectrometric procedure used in determining the N_2^{29+}/N_2^{28+} ratio allowed for detection of differences to 1 part in 3500. However, the absolute accuracy of the abundance measurements was limited to 1 part in 1000 because of the semimicro Kjeldahl distillation employed to determine the amount of $(NH_4)_2SO_4$ present in the solutions of the separated isotopes. In these measurements instrumental background played a very significant role. A reliable method of correcting the observed N_2^{29+}/N_2^{28+} ratio for the contribution of the background at these mass positions was developed. (auth)

2720 ISC-941

Ames Lab., Ames, Iowa.

RELATIVE APPARENT MOLAL HEAT CONTENTS OF SOME RARE EARTH CHLORIDES AND NITRATES IN AQUEOUS SOLUTIONS. Robert Eugene Eberts and F. H. Spedding. July 1957. 155p. Contract W-7405-eng-82. $3.00(OTS).

An adiabatically jacketed differential calorimeter, with a sensitivity of 5×10^{-4} calories per millimeter pen displacement of a recording potentiometer, was used to measure the heats of dilution of solutions of lanthanum chloride, ytterbium chloride, lanthanum nitrate, and ytterbium nitrate. The concentrations of the solutions ranged from 0.10 to 0.25 molal. The heats of dilution, which ranged from 0.05 to 2.0 calories, were measured to within a few thousandths of a calorie. The short-chord method of treating the heat of dilution data was used for the very dilute concentration range. This treatment yielded limiting equations for the concentration dependence of $\bar{P}_1$, which is the slope of a ϕ_L versus $m^{1/4}$ plot. Lanthanum chloride and nitrate gave limiting slopes of 6630 and 6230, respectively, compared with the theoretical limiting slope of 6925 as predicted by the Debye-Hückel interionic attraction theory. However, the ytterbium salts showed anomalous behavior in that the plot of $\bar{P}_1$ versus $m^{1/4}$ exhibited a maximum at about $m^{1/4} = 0.045$, dipping away from the theoretical limiting value below this concentration. The limiting slope was 247 for ytterbium chloride and −1393 for ytterbium nitrate. The anomalous behavior was explained by the presence of some polymeric-type species which form when the sample solution is diluted. Empirical expressions were derived for the following: the relative apparent molal heat content of solute, ϕ_L; the relative partial molal heat content of solvent, $\bar{L}_1$; and the relative partial molal heat content of solute, $\bar{L}_2$. Comparing the data with the predictions of the Debye-Hückel theory, it was found that the ϕ_L values for the lanthanum salts began deviating from the theoretical curves at a concentration of about 0.001 molal. The data for the ytterbium salts did not agree with the theory due to their anomalous behavior in the very dilute concentration range. An isothermally jacketed calorimeter, utilizing a transposed bridge type thermometer with a sensitivity of about 3.5×10^{-4} degrees per microvolt, was used to measure the heat of solution of neodymium chloride hexahydrate. From the values of the integral heats of solution at various molalities, the relative apparent molal heat content was calculated for the neodymium chloride in the solutions. The ϕ_L values thus obtained were in agreement with those previously reported from heats of dilution, but not with those derived from heats of solution of anhydrous neodymium chloride. Two possible explanations have been offered for the discrepancy in the previous heat of solution data. The first is based on a slow type reaction which might accompany the dissolution of the anhydrous salt; the second depends upon the hydrolysis of the rare earth ion when the salt is dissolved. (auth)

2721 ISC-945

Ames Lab., Ames, Iowa.

METAL-INDICATOR SYSTEMS IN (ETHYLENE-DINITRILO) TETRAACETIC ACID TITRATIONS. William J. Lane and J. S. Fritz. Dec. 1957. 116p. Contract W-7405-eng-82. $2.75(OTS).

Three organic reagents were studied and applied to titrations with (ethylenedinitrilo) tetraacetic acid. The techniques of photometric titrations and precision spectrophotometry have been applied to titrations of rare earths as dilute as 10^{-6} M. These reagents are 7-(1-naphthylazo)-5-sulfo-8-hydroxyquinoline or Naphthyl Azoxine, 2-(2-hydroxy-3,6-disulfo-1-naphthylazo)-benzene-arsonic acid or Thorin and 2-(1,8-dihydroxy-3,6-disulfo-2-naphthylazo)-benzenearsonic acid or Arsenazo. Naphthyl Azoxine was used as the indicator for direct EDTA titrations of some transition metals, rare earths and thorium. The interference of uranium was masked by tartrate ion in the titration of the transition metals but not rare earths and thorium. The copper-Naphthyl Azoxine complex was characterized as a 1:2 complex with a formation constant of 1.9×10^{15} at pH 6. Thorin was used as the indicator for indirect titrations of rare earths, several metals and fluoride ion. Lanthanum was used as the titrant of the excess EDTA. Arsenazo was used as the indicator for the direct EDTA photometric titration of the rare earths. Titrations of as little as 10 μg of rare earth were performed with an error only 2%. A tenfold excess of uranium was successfully masked in these titrations. The lanthanum-Arsenazo complex was characterized as a 1:1 complex with a formation constant of 2.7×10^8 at pH 7. (auth)

2722 KAPL-1728

Knolls Atomic Power Lab., Schenectady, N. Y.

LOW-TEMPERATURE REFLUORINATION OF PuF_6 DECOMPOSITION PRODUCTS. W. L. Robb, R. J. Brandon, R. L. Myers, and H. N. Galpern. Mar. 30, 1957. 45p. Contract W-31-109-Eng-52. $1.25(OTS).

The use of direct refluorination to recover plutonium deposited in equipment by consumption and decomposition of PuF_6 gas was the subject of a brief experimental program. Measurable rates of refluorination were obtained at temperatures as low as 170°C and by means of a statistically designed experiment; the approximate significance of the three variables, temperature, fluorine pressure, and fluorine flow rate, was determined. Temperature was found to be the most significant variable, and the heat of reaction based on removal rates measured from 170 to 350°C compared favorably with reported values obtained by equilibrating PuF_6 and F_2 gas mixtures. At plutonium surface concentrations below ~3 $\mu g/cm^2$, the rate of refluorination was found to be proportional to the plutonium surface concentration. In no case was the surface concentration decreased below 0.08 $\mu g/cm^2$. (auth)

2723 LA-1375

Los Alamos Scientific Lab., N. Mex.

APPLICATION OF A NEW TYPE CRUCIBLE TO THE PREPARATION OF URANIUM AND PLUTONIUM METAL BY THE STATIONARY BOMB METHOD. B. R. Hayward. Feb. 1952. Decl. Nov. 14, 1958. 25p. $4.80(ph OTS); $2.70(mf OTS).

Magnesium oxide crucibles were developed which increase the processing efficiency of uranium and plutonium production. The thin crucible design, allowing for a reduction in the weight of MgO sent to recovery, and other characteristics are described. (J.R.D.)

2724 LA-2160UNM

New Mexico. Univ., Albuquerque.

THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. X. m-CHLOROBENZYL IODIDE. Milton Kahn, J. L. Riebsomer, and R. N. Castle. Oct. 1957. 14p. For Los Alamos Scientific Lab. Contract [W-7405-Eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A measurable exchange was observed in methanol and ethanol between the iodine atom in m-chlorobenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over a temperature range from 0 to 31.0°C. The total iodide concentration in methanol and in ethanol ranged from 0.00174 to 0.0115M and 0.00168 to 0.0110M, respectively. The rate laws for the exchange reaction are $R = 2.0 \times 10^{12} e^{-17,000/RT}$ (m-ClBzI)(KI) in methanol, and $R = 3.8 \times 10^{12} e^{-16,960/RT}$ (m-ClBzI)(KI) in ethanol, where the units of R are moles $\times$ liter^{-1} $\times$ min^{-1}. (auth)

2725 NAA-SR-2942

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CRYOSCOPIC MEASUREMENTS IN MOLTEN MERCURIC CHLORIDE SOLUTIONS. S. W. Mayer. Sept. 1, 1958. 12p. Contract AT(11-1)-GEN-8. $0.50(OTS).

A series of measurements of the freezing point depressions produced in molten mercuric chloride solvent by Hg, Hg_2Cl_2, NaCl, NaBr, and K_2SO_4 solutes has been carried out. Although the results did not identify the species present in molten $HgCl_2$ solutions, they are herein reported as a set of observations which should be satisfied by a correct identification of the species. It was found that NaBr solute had the cryoscopic effect of two particles, while NaCl produced freezing point depressions corresponding to one particle. Mercurous chloride had the cryoscopic effect of one particle. Mercury also exhibited a cryoscopic effect of one, which is consistent with solution as mercury atoms or as Hg_2Cl_2. The mean cryoscopic number for K_2SO_4 was 1.6. (auth)

2726 NAA-SR-3043

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE SYNTHESIS OF BIPHENYL-3, 3', 5, 5' -d_4 AND BIPHENYL-d_{10}. R. I. Akawie. Oct. 15, 1958. 12p. Contract AT(11-1)-GEN-8. $0.50(OTS).

Biphenyl-3, 3', 5, 5'-d_4 has been prepared from aniline hydrobromide by a 4-step synthesis. Biphenyl-d_{10} has been prepared from benzene by a 3-step synthesis. The two deuterated biphenyls were 98.0 and 95.1 mole percent pure, respectively; the impurities consisted of biphenyls with a lower deuterium content. (auth)

2727 NLCO-753

National Lead Co. of Ohio, Cincinnati.

MEASUREMENT OF DISPERSION AND COALESCENCE (DISENGAGING) TIME: A LITERATURE SEARCH. Stephen Zakanycz. July 14, 1958. 26p. Contract AT(30-1)-1156. $0.75(OTS).

An annotated bibliography of the more pertinent literature dealing with the measurement of dispersion and coalescence times of immiscible organic-aqueous liquids is compiled. The source documents reviewed include the Nuclear Science Abstracts (1947-1957), Abstracts of Classified Reports (1947-1957), the National Lead Company of Ohio library card catalogue, the Chemical Abstracts (1950-1956), and the Engineering Index (1950-1956). (auth)

2728 NLCO-755

National Lead Co. of Ohio, Cincinnati.

MAGNESIUM SULFATE CHEMISTRY AND TECHNOLOGY: A LITERATURE SEARCH. Earl W. Mautz. June 2, 1958. 34p. Contract AT(30-1)-1156. $1.00 (OTS).

The literature relative to the chemistry and technology of magnesium sulfate is presented. The literature titles and Chemical Abstract numbers are given, together with a subject index. (auth)

2729 NP-7049

Hughes Aircraft Co. Microwave Lab., Culver City, Calif.

RESEARCH ON HIGH TEMPERATURE POLYMERS. Technical Report No. 1 [for] March 1, 1958 to September 1, 1958. John B. Rust and H. H. Takimoto. 50p. Contract Nonr-2540(00).

The syntheses of organometallic intermediates and polymers, and the measurement of physical-chemical properties of the resulting materials are described. A literature survey and preliminary laboratory studies led to the selection of the oxides of titanium and aluminum as two of the more promising classes of compounds for initial investigation. Compounds having the structure, $[(CH_3)_3\ SiO]_n Ti(OC_3H_7)_{4-n}$, where n = 1, 2, 3, 4, were prepared in good yields by the reaction of trimethylacetoxysilane with tetraisopropoxytitanium. These intermediates were reacted with appropriately substituted acetoxysilanes to produce polymers with a regularly ordered sequence of inorganic atoms, rather than a random arrangement of Si-O and Ti-O units. With one exception, bifunctional starting materials were used so that linear polymeric structures would be produced. Some of the resulting linear polymers consisted of Si-O-Ti-O chains while others had Ti-O-Ti-O backbones. A preliminary evaluation of the properties of the intermediates and polymers has been made by light scattering, viscosity, cryoscopic, and infrared spectroscopic techniques. (auth)

2730 NP-7092

Stauffer Chemical Co. Richmond Research Lab., Richmond, Calif.

INORGANIC POLYMERS PROGRAM. Semi-annual Technical Report for the Period January 1, 1958 to July 1, 1958. P. Barna, F. O. Groch, E. G. Teach, M. L. Ummel, and M. Weiner. 52p. Project No. NR-356-387. Contract Nonr-2259(00).

The physical properties of the polymers prepared from the reaction of diborane and various alkylene phosphines were investigated, and it was concluded that they are not stable enough to be useful. An isotope study was made of the reaction between $NaPH_2$ and R_f-I in two solvents, and a mechanism has been proposed. The investigation of the preparation and reaction of silyl phosphines is continuing. The preparation of cyclic perfluoroglutaroimidine has been investigated, and the stability

of this monomer was examined. Sufficient quantities were prepared to allow study of the preparation of the copolymer with perfluorobutyroamidine. In this study it was found that the rate of heating is critical with respect to the type of product obtained. If the heating is too slow, only a viscous oil is formed. Reaction conditions in terms of time and temperatures are described for small scale polymerizations. Scale-ups have, so far, not been consistently successful. Similar but less extensive work with perfluoroadipodiamidine has resulted in satisfactory polymers. A brief examination of materials of construction for a pilot plant unit has been carried out. (auth)

2731 NRL-5223

Naval Research Lab., Washington, D. C.

HIGH-TEMPERATURE LUBRICANTS FROM AROMATIC ACIDS AND FLUOROALCOHOLS. C. M. Murphy, J. G. O'Rear, H. Ravner, P. J. Sniegoski, and C. O. Timmons. Sept. 23, 1958. 13p. Project NA-350-063.

Aircraft gas-turbine engines soon to become operational will require lubricants which are considerably more resistant to pyrolysis and oxidation than are the alkyl diesters covered by Specification MIL-L-7808. Previous research at NRL revealed that fluoroalcohol esters of aliphatic acids had improved oxidation stability but were relatively volatile. To obtain esters with decreased volatility and increased stability, studies were extended to fluoroesters derived from aromatic acids, including the potentially available acids 2-phenylsuccinic, 2-phenylglutaric, diphenyl-2,2′-dicarboxylic or diphenic, and diphenyl ether 4,4′-dicarboxylic. The diphenate is preferred because of its oxidation stability at 527°F, its thermal stability at 600°F, and its lower volatility as compared with fluoroalcohol esters of aliphatic acids. These gains are made at some expense of viscometric properties and freezing point. The results of this investigation open the way to more stable and less volatile fluoroesters which offer promising candidates for high-temperature jet-engine lubricants. (auth)

2732 NYO-4878

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Apr. 30, 1958. 36p. Contract AT(30-1)-956. (MITS-39). $1.25(OTS).

Adsorption isotherms are given for treated and untreated quartz. The dissolution rate of quartz in water at various temperatures is presented. The surface chemistry of manganese dioxide is being investigated. The study of the magnitude of ion exchange in muscovite as a function of surface area was extended to include materials with surface area as large as 30.5 m^2/g. A study of the leaching of sphalerite by sulfuric acid and oxygen was initiated. The relation between the contact angle and the adsorption of solvents on the surface of quartz was investigated. An attempt was made to determine the thermal expansion coefficients of orthoclase, albite, and anorthite by an x-ray powder diffraction method. The mechanism by which heat treatment may cause intergranular fracture is being investigated. Studies of grain boundaries of quartz, orthoclase, and calcite are presented. (For preceding period see NYO-4876.) (W.L.H.)

2733 NYO-6013

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

ELECTROCHEMISTRY OF MOLTEN SALTS. Period Covered: June 1, 1954 to June 1, 1956. Earl H. Roland and G. M. Pound. June 1, 1956. 122p. Contract AT (30-1)-1432. $19.80(ph OTS); $6.30(mf OTS).

A new back-emf method for measuring the thermodynamic emf of molten salt cells of the type M/MCl_2 in molten salt solvent/Cl_2 is presented. Decomposition potentials are measured in the course of the thermodynamic emf determination. The systems $PbCl_2$–$ZrCl_2$, LiCl–KCl eutectic, LiCl–KCl–$NdCl_3$, $MgCl_2$ in LiCl–KCl and NaCl, $SnCl_2$, KCl, and $PbCl_2$, and $ZnCl_2$ in LiCl–KCl eutectic were studied. The thermodynamic emf's obtained by the back-emf method are in good agreement with values calculated from independent thermochemical data. Thus Raoult's law is thought to apply in these simple systems to within a factor of two in the activity coefficient. (auth)

2734 NYO-6591

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

A THERMODYNAMIC STUDY OF SOME COMPLEXES OF METAL IONS WITH POLYAMINES. Charles R. Bertsch, W. Conard Fernelius, and B. P. Block. Apr. 30, 1956. 20p. Contract AT(30-1)-907. $3.30 (ph OTS); $2.40(mf OTS).

The dissociation constants of the following amines have been determined at 10, 20, 30, and 40°C: N,N,N′,N′-tetramethylmethanediamine (I), 1,3-propanediamine (II), 1,4-butanediamine (III), cis- and trans-1,2-cyclohexanediamines (IV and V, resp.), 2,2′,2″-triaminotriethylamine (VI), and 1,3-diamino-2-propanol (VII), and at 10°C for trans(?)-1,2-cycloheptanediamine (VIII). Formation constants and enthalpy and entropy changes have been determined for the following: II with Ag^+, Cu^{2+}, and Ni^{2+}; III with Ag^+; IV and V with Cu^{2+}, Ni^{2+}, Zn^{2+}, and Cd^{2+}; VI with Cu^{2+}; and VII with Ag^+ and Ni^{2+} at the four temperatures. Formation constants have been determined for VIII with Cu^{2+}, Ni^{2+}, Zn^{2+}, and Cd^{2+} at 10°C. These quantities are compared from one ligand to another with the same metal ion. The difference in stability for the formation of different sized rings is primarily an entropy effect which is related to the strain introduced in the ring and the loss of freedom of the diamine in the chelate. The chelates formed with the cyclic diamines are generally more stable because of a more favorable entropy effect; however, there appear to be exceptions when the metal ion is not the proper size to fit a given diamine and weaker bonds result. An ion-exchange process for preparing diamine solutions directly from diamine salts is described. (auth)

2735 ORNL-1956(Del.)

Oak Ridge National Lab., Tenn.

ENTHALPIES AND HEAT CAPACITIES OF SOLID AND MOLTEN FLUORIDE MIXTURES. W. D. Powers and G. C. Blalock. Feb. 1, 1956. Decl. with deletions Nov. 13, 1958. 31p. Contract W-7405-eng-26. $6.30 (ph OTS); $3.00(mf OTS).

The enthalpies and heat capacities of seventeen fluoride mixtures in the liquid state have been determined using Bunsen ice calorimeters and copper block calorimeters. The fluoride mixtures were composed of the fluorides of two or more of the following metals: lithium, sodium, potassium, beryllium, zirconium, and uranium. The enthalpies and heat capacities of most of these mixtures were studied in the solid state also. Estimates of the heat of fusion have been made. General empirical equations have been developed which represent

the enthalpies and heat capacities of the fluoride mixtures in the liquid and in the solid state. (auth)

2736 ORNL-2278(Del.)
Oak Ridge National Lab., Tenn.
VISCOSITY MEASUREMENTS ON MOLTEN FLUORIDE MIXTURES. S. I. Cohen and T. N. Jones. July 12, 1957. Decl. with deletions Nov. 13, 1958. 50p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

A summary is presented of the experimental viscosity program on fused fluoride mixtures which has been carried out at the Oak Ridge National Laboratory. The experimental techniques which have been developed are described, data on the viscosity of 36 mixtures are tabulated, and several correlations involving these data are discussed. (auth)

2737 ORNL-2613
Oak Ridge National Lab., Tenn.
METHODS OF REMOTELY REMOVING THE BED FROM A SAND FILTER. C. O. Thornburg. Dec. 3, 1958. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40 (mf OTS).

Methods of remotely removing a sand bed from an isolated sand radiochemical filter were developed and tested, including a water eductor method, a pressurized vessel method, and a steam jet method. The last method appeared most reliable and practical, and special attention was given to determining optimum conditions for bed removal using a steam jet. (auth)

2738 ORNL-2628
Oak Ridge National Lab., Tenn.
TABLES OF THE ACTIVITY COEFFICIENT OF A 1-1 ELECTROLYTE AND ITS DERIVATIVES CALCULATED USING A MODIFIED DEBYE-HÜCKEL EQUATION. M. H. Lietzke. Dec. 11, 1958. 46p. Contract W-7405-eng-26. $1.50(OTS).

The tables are in two parts. Table 1 gives values of γ, $\log \gamma$, and the various derivatives as a function of ionic strength I and temperature t; the value of a' as defined in the equations is taken as 1.5. Table 2 gives the values of γ, $\log \gamma$, and the various derivatives at 25° as a function of ionic strength and the a' parameter; the value of a' varies from 0.25 to 3.25. (auth)

2739 PRL-5.24
Pennsylvania State Univ., University Park. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report for April, May, and June 1958. June 30, 1958. 88p. Contract AF33(616)-5460.

The program to evaluate the oxidation behavior of fluids and lubricants is presented. Test procedures to evaluate oxidation under conditions of (1) bulk oil, (2) thin films, (3) deposition, and (4) successive bulk oil conditions at different temperatures are outlined. These tests are designed to simulate various conditions of operation. The data indicate that the relative behavior of a series of fluids is not constant when tested under the different types of oxidative conditions. The major part of the current work comprises the evaluation of various mineral oil formulations in accordance with the types of oxidation tests listed above. These mineral oil formulations are designed to show the effects of molecular weight, super-refining (hydrogenation), and variations in the additive package for some paraffinic mineral oils. One series of formulations shows the progressive development of a complete additive package starting with an original blend comprising a super-refined paraffinic neutral, an oxidation inhibitor, and an antifoam additive. The additive package is completed by progressive addition of a dispersant, an antiwear additive, and a paraffinic resin. A second series of formulations has been evaluated to point out the effect of super-refining the base stock. The super-refined base stocks are more susceptible to the beneficial effects of the additive package than are the more conventionally refined base stocks. Another series of formulations has been evaluated to show the effect of increasing concentration of a dialkyl acid phosphite antiwear additive in the range of 0.0 to 0.5 weight per cent. Deposition type tests indicate some surface activity or metal deactivation for low concentrations (0.1 weight per cent or less) of the dialkyl acid phosphite in a paraffinic neutral. Higher concentrations of the order of 0.5 weight per cent dialkyl acid phosphite show increased dirtiness. A series of formulations has been evaluated to compare the effectiveness of an amine type inhibitor (phenyl-alpha-naphthylamine) and a dithiocarbamate as antioxidants in paraffinic neutrals and bright stocks. In general, the dithiocarbamate-inhibited super-refined paraffinic neutral containing a dispersant shows very good oxidation behavior. Two additional dispersants have been evaluated. These materials compare favorably with dispersants evaluated previously. A number of tests have been conducted to determine the effect of degree of refining and molecular weight on additive susceptibility. Paraffinic neutrals and bright stocks have been used as the base stocks for these studies. Three types of antioxidants have been used. Bulk oil tests at 347 and 500°F and thin film tests have been employed. Included in these studies are several tests in which the oxidation inhibitor has been added in increments. A low temperature dewaxing procedure is presented. Both paraffinic neutrals and bright stocks have been dewaxed according to this procedure at 0 and at −20°F. The dewaxed stocks have then been used in fuel dilution studies with JP-4 jet fuel. In addition, pour depressants have been used to lower the temperature at which these materials are fluid. (For preceding period see PRL-5.23.) (auth)

2740 RDB(W)TN-14
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
SURGING IN THE CONTINUOUS METAL DISSOLVING PROCESS. T. I. M. Crofts. 1958. Date of MS. Jan. 15, 1952. 5p.

In order to ascertain the probable causes of surging in the continuous dissolvers, a review has been made of the conditions leading to surging during the development work. It is concluded that surging is due to vigorous evolution of gas causing an increase in the liquor hold up in the dissolver, followed by a reduction in gas evolution accompanied by a surge of liquor from the overflow pipe. These conditions are met when the acid strength and temperature of the dissolver liquor (and hence the dissolving rate) are high. (auth)

2741 SCR-54
Sandia Corp. Albuquerque, N. Mex.
A CASTABLE POLYURETHANE. A. J. Quant. Oct. 1958. 13p. Contract AT(29-1)-789. $0.50(OTS).

Presented at Meeting of the Materials and Standards Engineering Organization, Sandia Corp., Sept. 1958.

A castable polyurethane elastomer with outstanding thermal-shock resistance has been developed from commercially available materials. An isocyanate-terminated prepolymer, Adiprene-L, when cured with

an amine/polyol mixture, produces an elastomer of superior physical properties with reasonable processing characteristics. (auth)

2742 SCS-M-119

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF PEROXIDES IN ETHER DISTILLATE AND ETHEREAL URANYL NITRATE SOLUTIONS. 1958. Date of MS. Jan. 26, 1949. 5p.

Peroxides are estimated colorimetrically by shaking the sample with ammonium thiocyanate and ferrous ammonium sulfate solutions and comparing the color produced with artificial standards. The method is suitable for concentrations of 1 to 10 ppm. (auth)

2743 SCS-M-123

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE CLEANING AND PREPARATION OF URANIUM METAL. 1958. Date of MS. Sept. 16, 1948. 3p.

The sample is boiled with water to remove any oil from the surface of the metal and most of the adherent foreign matter. After washing with tap water, the sample is warmed with dilute nitric acid to remove surface oxide and any remaining surface contamination. The metal is then washed with hot water and dried in an oven at 75°C. (auth)

2744 SCS-M-171

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF CHLORIDE IN URANIUM TETRAFLUORIDE. 1958. Date of MS. Oct. 26, 1954. 5p.

The fluoride is complexed with aluminum nitrate and the chloride separated by distillation and subsequently determined turbidimetrically using silver nitrate. The method is suitable for the determination of 0 to 10 ppm of chloride. (auth)

2745 WADC-TR-57-391(Pt. II)

Illinois. Univ., Urbana.

POLYMERIZATION THROUGH COORDINATION. Period covered: October 1, 1956 to September 30, 1957. John C. Bailar, Jr., K. V. Martin, Malcolm L. Judd, and John McLean. Apr. 25, 1958. 60p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3209. (AD-155799).

The study of the formation of polymers containing coördinated heavy metals has been continued. Bis-chelating agents which are bidentate should form linear polymers by coördination with tetracoördinate metal ions. Studies have been made of polymers of this sort containing zinc, nickel, and copper(II) coördinated with bis-thiopicolinamides, bis-fluorinated 1,3-diketones, bis-amino acids, and bis-8-hydroxyquinolines. The reaction of tetrahydroxy aromatic compounds with silicon tetrachloride is of this type and has been studied. Bis-chelating agents which are tridentate should form linear polymers by coördination with hexacoördinate metal ions. A brief study of coördination compounds of two tridentate amino acids (β-amino glutaric acid and iminodiacetic acid) showed that such polymers would not have great stability, so the matter was not pursued further. The study of the formation of polymeric copper phthalocyanines from derivatives of pyromellitic acid has been continued, but no method for the preparation of high molecular weight polymers has yet been found. It has been demonstrated that polymers can be formed by the condensation of monomeric coördination compounds which contain uncoördinated functional groups such as hydroxyl and carboxyl. Although the materials which have been obtained are only trimers and do not show good heat stability, their formation is encouraging, as it furnishes a tool for the study of the polymerization process. An apparatus for the measurement of heat stabilities of polymers is described. (auth)

2746 WADC-TR-58-89

Products Research Co., Los Angeles.

DEVELOPMENT OF HIGH TEMPERATURE SEALANTS. [Period covered] February 1, 1957 to February 1, 1958. Irvin P. Seegman, William Cheorvas, Francis H. Ingham, Sarkis H. Kalfayan, Paul A. Mallard, Ron E. Thompson, and R. Loren Varner. Apr. 25, 1958. 170p. Project Nos. 7340 and 3048. Contract AF33(616)-3976. (AD-155606).

A fill and drain sealant based on Viton A was developed which has excellent resistance to fuels at 450°F. The fill and drain system consists of a dilute solution of Viton A and phenolic resins as a primer, a Viton A sealant compounded with silicone coated silica and magnesium oxide at 28% solids in methyl isobutyl ketone and an amine curing solution. An 80% solids filleting sealant with excellent resistance to fuel and dry heat at 450°F and adequate low temperature properties has been developed from Viton A cured with hexamethylene diamine. The sealant can be cured adequately in one hour at 250°F but requires an additional 2 hours at 350°F to develop adhesion. A 100% solids filleting formulation based on PAH-1 was cured with benzoyl peroxide to an elastomeric material which had excellent resistance to Type III and JP-5 fuels at 350°F, but its initial tensile strength properties were not of a very high order. A groove sealant formulated from LS-53U and 1F4 maintained its seal and was capable of reinjection after 6 days immersion in Type II reference fluid or JP-4 fluid at 275°F followed by 7 days at 350°F or 2 days at 450°F with equally satisfactory results. The compound met the major requirements of the proposed 250°F Military Groove Sealant Specification and the sealing and reinjection requirements of this specification when tested at 350 and 450°F. Compounds were developed which should be suitable for use as non-fuel resistant pressurization sealants for high-temperature exposures to 700°F. Formulations are based on room-temperature vulcanizing silicone compounds. For elevated temperature service a stepwise post cure up to the anticipated operating temperature is required. (auth)

2747 WSL-R-39

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

PREPARATION OF THIN UNIFORM FILMS OF PuO_2 SUITABLE FOR FISSION FRAGMENT COUNTING. J. Shaw, A. Whittaker, L. Polley, and G. Wortley. 1958. Date of MS. Aug. 12, 1952. 7p.

Thin films of PuO_2, suitable for determination of Pu^{240} by counting the number of spontaneous fissions, can be prepared by dropping a plutonium solution on to the center of a spinning disk and igniting the salt to oxide. (auth)

2748 AEC-tr-3397
BINDING OF ALKALI METALS BY CARBON. V. K. Fredenhagen and H. Suck. Translated by K. S. Bevis (Savannah River Lab.) from Z. anorg. u. allgem. Chem. 178, 353-65(1929). 13p.

The type of potassium and sodium binding by carbon was investigated under the same pressure and temperature conditions; carbon black and graphite adsorbed the same amounts of potassium. Sodium reacted with carbon black but not with graphite, and diamond reacted with neither. Potassium was adsorbed by graphite in two distinct stages. Potassium carbide was not formed. (J.R.D.)

2749 AEC-tr-3461
CONTEMPORARY STATE OF ANALYTICAL CHEMISTRY OF ZIRCONIUM. V. G. Goryushina (Gorjushina) and V. M. Vladimirova. Translated from Zavodskaya Lab. 22, 1171-80(1956). 16p.

This paper was translated into English by Ladish Co.'s Mr. Hanzely and then reorganized by R. C. Ilia of the Ladish Chemistry Div.

A review of analytical methods for zirconium determination is presented. Methods of separating zirconium and gravimetric determinations are described, as well as volumetric methods, such as the selenite and phosphate methods. In addition, direct and indirect titrations are described, along with colorimetric methods. 105 references. (J.R.D.)

2750 AEC-tr-3481
APPLICATION OF CATION EXCHANGE IN MICRO-CRYSTALLOSCOPIC ANALYSIS. A. G. Koblyanskii (Koblyanski). Translated for Oak Ridge National Lab. from Trudy Komissii Anal. Khim. Akad. Nauk S.S.S.R., Inst. Geokhim. i Anal. Khim. 7, 89-95(1956). 8p.

A new method of micro-crystalloscopic detection of cations is proposed, based on introducing the cationite grains, subjected to ion exchange, into a drop of the corresponding reagent. This method makes it possible to detect ions absorbed by the cationite from the solution, the concentration of which is 10 to 40 fold lower than the limiting concentration for the corresponding micro-crystalloscopic reaction. (auth)

2751 AEC-tr-3483
THE DETERMINATION OF THORIUM ON THE MILLIMICROGRAM SCALE. E. Picciotto and S. Wilgain. Translated for Los Alamos Scientific Lab. from Anal. Chim. Acta 16, 530-40(1957). 11p.

Thorium in solution is measured by the tracks of alpha particles, from radiothorium in photographic emulsions. Using the method described, it is possible to detect radiothorium in equilibrium with 10^{-9} g Th, contained in a volume of several hundredths of a milliliter, in the presence of all the other stable or radioactive nuclides. The accuracy is limited chiefly by the statistical fluctuations of the number of disintegrations, the experimental errors being about ±3%. The method was evaluated by use of standard solutions. The experimental techniques, diffusion of thoron, and interference by radioactinium are discussed in detail. (auth)

2752 AEC-tr-3485
PHOTOMETRIC DETERMINATION OF THORIUM WITH ARSENAZO IN THE PRESENCE OF ZIRCONIUM, TITANIUM AND RARE EARTHS. F. V. Zaikovskii (Zaikovsky) and L. I. Gerkhardt. Translated for Oak Ridge National Lab. from Zhur. Anal. Khim. 13, 274-9 (1958). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13758.

2753 AEC-tr-3496
INVESTIGATION OF THE OXALATE AND CARBONATE COMPLEXES OF PLUTONIUM(IV) IN AQUEOUS SOLUTIONS BY THE SOLUBILITY METHOD. (Issledovaniye Oksalatnykh i Karbonatnykh Kompleksov Plutoniya(IV) v Vodnykh Rastvorakh Metodom Rastvorimosti). A. D. Gel'man and A. I. Moskvin. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 118, 493-6(1958). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 8378.

2754 AEC-tr-3499
STATE OF MICROELEMENTS IN AQUEOUS SOLUTIONS. I. E. Starik and M. S. Lambert. Translated for Oak Ridge National Lab. from Zhur. Neorg. Khim. 3, 136-8(1958). 7p.

The absorption of promethium on quartz glass in concentrations of the order of 10^{-10} M was investigated as a function of the solution pH. The presence in these solutions of promethium in the colloid state was shown by ultra-filtration. It has been established that there is a clear adsorption maxima of promethium on glass at a pH of 6.2. (auth)

2755 AEC-tr-3505
INVESTIGATION OF PHYSICOCHEMICAL PROPERTIES OF PLUTONYL FLUORIDE. (Izucheniye Fiziko-Khimicheskikh Svoistv Ftoristago Plutonila). Translated by Lydia Venters (Argonne National Lab.) from Zhur. Neorg. Khim. 3, 951-5(1958). 10p.

A technique of synthesis of PuO_2F_2 by its precipitation from chloride solutions of hexavalent Pu by liquid HF is presented. A chemical investigation of PuO_2F_2 is carried out; its composition expressed by the formula PuO_2F_2 is established on the basis of these studies. The electron and infrared absorption spectra of PuO_2F_2 proving the presence of PuO_2^{2+} ions and the absence of tetravalent Pu in the compound were studied. The crystalline structure of PuO_2F_2 corresponding to rhombohedral lattice with constants a = 5.797 ± 0.005A; $\alpha = 42° \pm 3'$ was determined. The solubility of PuO_2F_2 in water at 20°C equal to 1.07 g/liter is established. (auth)

2756 UCRL-Trans-368
AN ANALYSIS OF THE THERMODYNAMIC PROPERTIES OF ARGON, NITROGEN AND ARGON–NITROGEN MIXTURE BY THE METHODS OF STATISTICAL THERMODYNAMICS. I. A. Rogovaya and I. P. Ishkin. Translated for Univ. of Calif. Radiation Lab. from Zhur. Fiz. Khim. 31, 573-81(1957). 15p.

A calculation of the intermolecular energy and the thermodynamic properties of argon and argon–nitrogen mixtures was made, based on the experimentally determined isothermal coefficient of throttling. From the isothermal coefficient data at zero pressure the characteristic constants were obtained for the Lennard-Jones potential. The intermolecular potential constants for the argon–nitrogen mixture were calculated from those for the pure gases. Then with the aid of the Lennard-Jones potential and statistical thermodynamics the zero pressure isothermal coefficient of throttling for different temperatures, the specific volumes, and the coefficients of throttling at pressures close to the critical were calculated for argon, nitrogen, and a 50%

argon–nitrogen mixture. It was shown that the potential used describes with sufficient accuracy the intermolecular energy of compounds with close values of the dimensionless critical parameters. This condition was found to be a reliable criterion for the applicability of the theory of corresponding states. (auth)

2757

THE SOLUBILITY OF URANIUM PEROXIDE IN ACIDIC AND BASIC MEDIA AT 25°C. Karl H. Gayer and Lancelot C. Thompson (Wayne State Univ., Detroit). Can. J. Chem. 36, 1649-52(1958) Dec.

The solubility of uranium peroxide ($UO_4 \cdot 2H_2O$) was measured in NaOH and $HClO_4$ solutions. Possible reactions of $UO_4 \cdot XH_2O$ in dilute $HClO_4$ solutions and possible reaction of $UO_4 \cdot XH_2O$ in dilute NaOH solutions are indicated along with the calculated constants. As might be expected, the several oxygens associated with the uranium atom appear to make the hydroxide more acidic than basic. (auth)

2758

A NEW METHOD BASED ON PAPER CHROMATOGRAPHY FOR THE DETERMINATION OF URANIUM IN URANIUM MINERALS. I. I. M. Elbeih and M. A. Abou-Elnaga (Univ. of Cairo). Chemist Analyst 47, 92-3(1958) Dec.

A titration using ethylenediaminetetraacetate for uranium determination is described. Xylenol orange is used as indicator. This method makes possible the separation of uranium from other constituents of its mineral by paper chromatography, and subsequent determination via the EDTA titration. The method is fully described. (J.R.D.)

2759

EDTA TITRATION OF MICRO QUANTITIES OF RARE EARTHS. K. L. Cheng (Kelsey-Hayes, Utica, N. Y.). Chemist Analyst 47, 93-4(1958) Dec.

The ethyelediaminetetraacetate (EDTA) microtitration of all the rare earths except radioactive promethium in the tervalent state, and in the pH range of 4 to 10, with 1-(2-Pyridylazo)-2-naphthol(PAN) as an indicator, is described. Diethylenetriaminepentaacetic acid (DPTA) is as satisfactory as EDTA and may be substituted for the latter in this titration. (J.R.D.)

2760

HISTAMINE OBSERVED IN CONTACT WITH A RADIUM SOURCE. PRELIMINARY RESULTS. Simone Hatem. Compt. rend. 247, 1420-2(1958) Oct. 27. (In French)

The viscosity and ultraviolet absorption of histamine placed in contact with a point source of radium are altered. (tr-auth)

2761

THE NATURE OF CERTAIN "EQUILIBRIA" IN THE CERIUM–HYDROGEN SYSTEM. ATTEMPT AT INTERPRETATION. Halim J. Albany. Compt. rend. 247, 1452-5(1958) Nov. 3. (In French)

The results of experiments on the cerium–hydrogen system are reported. The cerium samples, in powdered form, were placed in the presence of an excess of hydrogen at room temperature and at 300°C. A sigmoid transformation at constant volume occurred. With a rapid increase in temperature a desorption is observed, followed by an absorption, which is succeeded by a new desorption. Possible interpretations are discussed. It is concluded that only an external layer of grains rich in faults and in hydrogen would be in equilibrium with the gas. Because of the existence of a gradient in hydrogen concentration, a preferential diffusion of faults, contributing to the creation of zones very rich in lacunes, is suggested. (J.S.R.)

2762

THE SULFIDES OF YTTERBIUM. Louis Domange, Jean Flahaut, Micheline Guittard, and Jean Loriers. Compt. rend. 247, 1614-16(1958) Nov. 10. (In French)

The sulfide Yb_2S_3 is formed by heating Yb_2O_3 in contact with hydrogen sulfide to 1300°C to eliminate the oxygen. The resulting compound is then heated with sulfur at 1100°C for one hour or at 800°C for three or four hours. The crystalline structure is an orthorhombic cell with the parameters a = 6.78, b = 9.95, and c = 3.61. The density is 6.02, and the magnetic susceptibility at room temperature is 7130×10^{-6}. Heating Yb_2O_3 to 1350 to 1400°C in hydrogen sulfide leads to the production of a compound with the approximate composition $YbS_{1.43}$. Heating Yb_2S_3 leads to a product with a very similar x-ray spectrum, but with a composition $YbS_{1.33}$ (Yb_3S_4). The densities are 6.44 and 6.72, respectively, and the magnetic susceptibilities are 2977×10^{-6} and 2197×10^{-6}. The heating of the other sulfides in a vacuum produces a compound with the composition $YbS_{1.11}$. X-ray-diffraction patterns show a cubic phase of the NaCl type, whose a parameters vary with the sulfur content. All the products are deep blue and are easily attacked by dilute acids. (J.S.R.)

2763

THE ELECTROCHEMICAL BEHAVIOR OF ALUMINUM. POTENTIAL pH DIAGRAM OF THE SYSTEM Al-H_2O at 25 C. E. Deltombe and M. Pourbaix (Centre Belge d'Etude de la Corrosion, Brussels). Corrosion 14, 496t-500t(1958).

A study was made of electrochemical behavior of aluminum in the presence of aqueous solutions. The potential-pH equilibrium diagram of the system aluminum-water at 25 C was developed from the standard free energies of the constituents, and the general electrochemical behavior of aluminum was deduced from the diagram. The diagram was established by considering the ions Al^{+++} and AlO_2^- and the solid phases Al and $Al_2O_3 \cdot 3\,H_2O$ (hydrargillite). The diagram indicates the theoretical circumstances in which aluminum should show corrosion, immunity, and passivity, under the hypothesis that the passivation results from the formation of a film oxide whose stability resembles that of hydrargillite. The stability of aluminum and the different forms of its oxides are discussed. Curves are given of the solubilities of the oxides and hydroxides as functions of pH. (auth)

2764

THE EFFECT OF THE SUBSTITUTION OF HYDROGEN WITH DEUTERIUM ON THE POLARIZATION OF MOLECULES. I. B. Rabinovich and Z. V. Volokhova (Lobachevskii Gor'kii State Univ.). Doklady Akad. Nauk S.S.S.R. 122, 844-7(1958) Oct. 11. (In Russian)

The light dispersion and density were investigated, and statistical polarization (α_0) for 12 liquid deutero-compounds and their hydrogen analogs was calculated. The refractive index was measured with a refractometer with relative accuracy 2×10^{-5} at 293°K for lines Hα, D, Hg, Hβ, and Hg$_{1-f}$. Statistical polarization by means of extrapolation up to $\nu = 0$ of functions $(n^2 + 2)(n^2 - 1)$ from ν^2 when ν is the light frequency. All 12 deutero-compounds have a lower refractive index and smaller polarization than the corresponding hydrogen compounds. (R.V.J.)

2765

HYDROGEN (PROTIUM)-DEUTERIUM EXCHANGE IN CLAYS. J. Moum and I. Th. Rosenqvist. Geochim. et Cosmochim. Acta 14, 250-2(1958) Sept.

The mobility of the hydrogen in clay minerals has been examined by exchange reactions with deuterium dioxide. It was found that the hydrogen of the clay minerals was present in three distinct states, each with its particular rate of exchange. The adsorbed water is exchanged in a matter of seconds or minutes; the H_3O^+ water in a matter of weeks, and the OH^- water in a matter of years or even centuries. (auth)

2766

CATALYTIC DECOMPOSITION OF HYDROGEN PEROXIDE AND URANYL PEROXIDE. Louis Silverman, Robert Sallach, Rachel Seitz, and Wanda Bradshaw (North American Aviation, Inc., Canoga Park, Calif.). Ind. Eng. Chem. 50, 1785-6(1958) Dec.

Decomposition rates are given of peroxide in dilute uranyl sulfate–hydrogen peroxide solutions. A wide variety of catalysts and combination of catalysts was tested, but the investigation was generally limited to the pH range of 1 to 3. The effects of temperature, catalyst concentration, acidity, and uranium concentration on the decomposition are discussed. (J.H.M.)

2767

ANION-EXCHANGE STUDIES. IV. NATURE OF THE ADSORBED SPECIES IN THE SYSTEM Co(II)–HCl. Rolfe H. Herber and John W. Irvine, Jr. (Univ. of Illinois, Urbana and Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 80, 5622-4(1958) Nov. 5.

The spectra of Co(II) solutions in the presence of LiCl, HCl, and $HClO_4$ have been re-examined in the region from 325 to 650 mμ. The optical absorbancy data have been correlated with the known adsorption behavior of Co(II) on strong-base (quaternary ammonium) anion-exchange resins, and the principal species adsorbed on the resin is shown to be the neutral complex $CoCl_2 \cdot aq$. The equilibrium constant for the reaction $Co^{++} \cdot aq + 2Cl^- \rightleftharpoons CoCl_2 \cdot aq$ is calculated to be 5.3×10^{-2} F^{-2}. These data appear to support the suggestion that at least two distinct anion adsorption processes may occur in transition metal ion retentions. (auth)

2768

A KINETIC STUDY OF THE REDUCTION OF NEPTUNIUM(VI) BY HYDROGEN PEROXIDE. A. J. Aielen, J. C. Sullivan, D. Cohen, and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 80, 5632-5(1958) Nov. 5.

The rate of the forward reaction in the stoichiometric equation $2NpO_2^{+2} + H_2O_2 = 2NpO_2^+ + 2H^+ + O_2$ was studied in a perchloric acid–sodium perchlorate medium. The rate law deduced, $(dNpO_2^+/dt)_{t=0} = k[H_2O_2][NpO_2^{+2}]/[H^+](1 + k'[NpO_2^+]/[NpO_2^{+2}])$ was verified for a wide range of the explicit variables. The effects of temperature, ionic strength and deuterium on the rate were determined. (auth)

2769

THE RADIATION CHEMISTRY OF DEAERATED FERROUS CHLORIDE SOLUTIONS. Harold A. Schwarz and Jane M. Hritz (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 80, 5636-8(1958) Nov. 5.

The oxidation of deaerated $FeCl_2$ solutions in 0.4 M HCl is qualitatively similar to the oxidation in H_2SO_4. However, the decrease in yield due to accumulation of Fe(III) as the reaction proceeds is much more marked in HCl solutions. In the presence of Fe(III), the yield approaches equivalence with the molecular H_2 formed by the radiation. This property allows accurate measurement of the hydrogen yield in 0.4 M HCl solutions and the variation of the yield with Fe(III) concentration. The ratio of rate constants for the reactions $H + Fe(III) \rightarrow H^+ + Fe(II)$ and $H + H^+ + Fe(II) \rightarrow H_2 + Fe(III)$ is found to be 170, and the molecular H_2 yield is found to vary according to the relation $G_{H_2} = 0.45 - 0.64(Fe^{III})^{1/2}$ where G_{H_2} is the number of H_2 molecules produced per 100 e.v. adsorbed in the solution. (auth)

2770

SPECTRAL INVESTIGATIONS OF METAL COMPLEXES OF β-DIKETONES. I. NUCLEAR MAGNETIC RESONANCE AND ULTRAVIOLET SPECTRA OF ACETYLACETONATES. R. H. Holm and F. A. Cotton (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 80, 5658-63(1958) Nov. 5.

A report of proton resonance and ultraviolet spectra of a broad range of metal ion complexes of acetylacetone is presented. The n.m.r. spectra of diamagnetic complexes provide no support for the postulate of benzenoid resonance in the chelate rings, as has been suggested by Calvin nor are any great differences in electron density at the unique carbon atom in the ring indicated. Definitive ultraviolet spectra of thirty acetylacetone complexes are reported. All of these data in general and particularly in certain comparisons indicate that the electrostatic model of Belford, et al., cannot account for the variation in energy of the presumed $\pi - \pi^*$ transition. The energy of this transition cannot be correlated with any simple parameter of the complexed metal ion, and it is believed that it is determined by several such parameters, among which is the ability of the metal ion to participate in $d\pi - p\pi$ overlap with the π system of the chelate ring. (auth)

2771

SOME PRECURSORS PRODUCED IN THE ELECTRODELESS DISCHARGE SYNTHESIS OF B_2Cl_4. R. T. Holzmann and W. F. Morris (Univ. of California, Livermore). J. Chem. Phys. 29, 677(1958) Sept.

The method of production by microwave excitation and the precursors in the synthesis of B_2Cl_4 from BCl_3 are described. It is thought that BCl may be considered an important intermediate, and although the BCl_2 spectrum was not observed, this may be due to its appearance in a region outside that investigated, or the energy absorbed may be higher than the dissociation energy resulting in immediate rupture. The work is presently being extended to include the infrared region of the spectrum. (auth)

2772

THE REACTION OF ALUMINIUM CHLORIDE WITH LITHIUM BOROHYDRIDE. W. M. Olson and R. T. Sanderson (State Univ. of Iowa, Iowa City). J. Inorg. & Nuclear Chem. 7, 228-30(1958) Oct.

The synthesis of aluminum borohydride by the reaction between lithium borohydride and aluminum chloride seems to occur, at least in part, through the decomposition of very unstable, volatile intermediates. Attempts to isolate these intermediates in pure state were unsuccessful but by trapping intermediate fractions at low temperatures and destroying them with excess hydrogen chloride, it was possible to obtain analytical evidence consistent with the identification of the intermediate compounds as $Al(BH_4)Cl_2$ and $Al(BH_4)_2Cl$. (auth)

2773

THE THERMAL DECOMPOSITION OF AMERICIUM (III) OXALATE. T. L. Markin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 290-1(1958) Oct.

Hydrated americium oxalate was precipitated from a nitrate solution by a few drops of a saturated solution of oxalic acid and dried in a vacuum (1 μ) at room temperature. Americium of high purity was used; the only impurities detected were Mg(0.5), Al(0.5) and Si(0.2 per cent). The thermal decomposition of americium oxalate in air and in vacuo, was studied with the aid of a thermogravimetric balance. The oxalate was heated at the rate of 3°C per minute and readings were taken at 5°C intervals. (auth)

2774

THE PREPARATION OF RHENIUM FROM IODO COMPOUNDS. A. A. Woolf (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 291-2(1958) Oct.

Potassium hexaiodorhenate (IV) decomposes in vacuo at 500° mainly to potassium iodide, rhenium and iodine. At 700° potassium iodide sublimes off to leave an iodine-free product, but analyses showed retention of potassium. This cannot be ascribed to the retention of alkali as in the hydrogen reduction of potassium perrhenate, and it indicates that an unsolvated potassium rhenide is stable at high temperatures. Ammonium hexaiodorhenate (IV) prepared quantitatively from rhenium heptoxide decomposes quantitatively to rhenium at 700° in vacuo. A compound approximating to rhenium tri-iodide was prepared by evaporating the eluate, obtained by passing potassium hexachlororhenate in hydrochloric acid through a cation exchange column, to dryness with hydriodic acid. This iodide also decomposed to rhenium in vacuo. We have confirmed and extended the observations that rhenium iodides cannot be prepared by direct combination alone or in complexing and non-complexing solvents for iodine. The hexaiodorhenates can be prepared quantitatively from the corresponding chlorides. It has been shown that the series K_2ReCl_6, K_2ReBr_6 and K_2ReI_6 can be interconverted in either direction with the appropriate halogen acids but with greater difficulty to the left. The hexachloro salt is converted to potassium perrhenate and bifluoride with hydrofluoric acid and not to the hexafluoro salt. The last resembles the hexafluoro iridate and not osmate or platinate. (auth)

2775

ON THE PREPARATION OF IODINE PENTAFLUORIDE. G. A. Olah, A. E. Pavlath, and S. J. Kuhn. J. Inorg. & Nuclear Chem. 7, 301-2(1958) Oct.

The reaction between I_2O_5 and liquid BrF_3 was found to be a suitable laboratory preparative method for the preparation of IF_5. The reaction can be performed in a silica flask with no special equipment needed. The yield of the isolated pure IF_5 is 80%, although the reaction is nearly quantitative. Some material is dissolved in the Br formed as a by-product of the reaction and is lost. In addition, it was found that liquid ClF_3 reacts with IF_5. The purification of the product can be accomplished readily as the volatile chlorine in the reaction is easily removed. The lower melting point of the ClF_3 makes it possible to work at a convenient low temperature and at the same time control the heat of reaction. (T.B.A.)

2776

VAPOR PRESSURES AND MOLECULAR COMPOSITION OF VAPORS OF THE $RbF-ZrF_4$ AND $LiF-ZrF_4$ SYSTEMS. Karl A. Sense and Richard W. Stone (Battelle Memorial Inst., Columbus, Ohio). J. Phys. Chem. 62, 1411-18(1958) Nov.

The vapor pressures of RbF and LiF were measured over the temperature intervals 589—1059° and 851—1060°, respectively. Thermal analysis showed the melting point of RbF to be 798°. Vapor pressures of the $RbF-ZrF_4$ and $LiF-ZrF_4$ systems were measured over the ranges 690—1060° and 670—1060°, respectively. On the basis of previously developed theory, it was concluded that the complexes $RbZr_2F_9$ and $LiZr_2F_9$ exist in the vapor phase of the respective systems. Further work on the $NaF-ZrF_4$ system points to the existence of the gaseous complex $NaZr_2F_9$ rather than $NaZrF_5$ as previously supposed. A phase diagram of the $RbF-ZrF_4$ system derived from vapor pressure data shows a constant boiling point to exist at about 33 mole % ZrF_4 for a total pressure of 1 mm. Plots showing the change of total pressure with composition for various temperatures, as well as melting point curves, are given for the various systems. (auth)

2777

THE MAGNETIC SUSCEPTIBILITIES AND STRUCTURES OF THE ANHYDROUS ZIRCONIUM TETRAHALIDES. Winston R. deMonsabert and Edward A. Boudreaux (Loyola Univ. of the South, New Orleans). J. Phys. Chem. 62, 1422-6(1958) Nov.

The magnetic susceptibilities of ZrF_4, $ZrCl_4$, $ZrBr_4$, and ZrI_4 have been determined by the Gouy method. All compounds were found to be diamagnetic as expected, with susceptibility values of: -0.194×10^{-6}, -0.302×10^{-6}, -0.261×10^{-6}, and -0.191×10^{-6}, respectively. Experimental molar susceptibilities are compared with theoretical calculations based on an approximation to Van Vleck's original expression for polyatomic molecules. The agreement is good for ZrF_4 and $ZrCl_4$, but some discrepancy arises with $ZrBr_4$ and ZrI_4 unless polarization effects are taken into consideration. Determinations also have been made regarding susceptibility vs. temperature for $ZrCl_4$ and $ZrBr_4$ ranging from 30 to 350°. The results indicate that there is no presence of complex resonance isomers in the solid state. The total evidence presented, though not absolutely conclusive, indicates a tetrahedral arrangement for these molecules. (auth)

2778

ThO_2-PuO_2 AND CeO_2-PuO_2 SOLID SOLUTIONS. Robert N. R. Mulford and F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 62, 1466-7 (1958) Nov.

An investigation was made of the x-ray lattice parameter-composition relationship for ThO_2-PuO_2 and CeO_2-PuO_2 solid solutions. Lattice parameters vs. compositions of solutions are presented in tables and graphs. (J.R.D.)

2779

SYNTHESIZING HEAT-RESISTANT MATERIALS [CARBIDES, NITRIDES, BORIDES, SILICIDES, AND SULFIDES OF THE METALS OF GROUPS IV, V, AND VI]. N. P. Zvereva. pp. 325-48 in "Fiz.-Khim. Osnovy Keramiki." Moscow, Promstroyizdat, 1956. (Translated from Referat. Zhur. Met. No. 2, 1958, p. 12)

A survey is made of the properties of superduty refractory materials with fusion temperatures of 2,000 to 4,000°C, and of methods of synthesizing them. The carbides possess the highest temperature range; then come the nitrides, borides, silicides, and sulfides.

A system is described for fashioning products out of superduty refractory materials, and data are included on the chemical and physical properties of individual superduty refractories. Some of the characteristics of the technology of products made of TiC, UN, ZrB_2, $MoSi_2$, and ThS are given. 56 references. (TCO)

2780

SEPARATING NIOBIUM AND TITANIUM IN THE FORM OF COMPLEX CHLORIDES. B. Ya. Tratsevitskaya, V. G. Trusova, D. M. Chizhikov, and V. N. Korsunskaya. Trudy Inst. Met. Akad. Nauk No. 2, 87-91(1957). (Translated from Referat. Zhur. Met. No. 2, 1958, p. 63)

A study was made of the behavior of complex chlorides of Nb and Ti with K and NH_4 in HCl solutions saturated with gaseous HCl at temperatures from 0 to −10°C. The Ti concentration varied from 0.3 to 15 g/l and the Nb concentration from 5 to 15 g/l. The Ti:Nb ratio varied from 1:1 to 1:150. The potassium or ammonium compounds were added in excess amounts. At low concentrations of Ti, it was possible to precipitate 96%, but the precipitation effectiveness decreased as the Ti concentration increased. The percentage precipitated increased when the temperature was lowered to −10°C. At Nb concentrations lower than 15 g/l, Nb did not precipitate unless Ti was present. Nb concentration did not affect Ti precipitation. (J.S.R.)

2781

USING PHYTIN FOR QUANTITATIVE DETERMINATION OF ZIRCONIUM. I. P. Alimarin and L. Z. Kozel'. Khim. Redkikh Elementov Akad. Nauk S.S.S.R., Inst. Obshchei i Neorg. Khim. No. 3, 114-18(1957). (Translated from Referat. Zhur. Met. No. 2, 1958, p. 299)

A gravimetric method for the determination of zirconium is described. It is based on the precipitation of zirconium from an acid solution with phytin. The method can be used for the determination of zirconium in steels, although a three-stage reprecipitation is sometimes necessary. The relative error is ±3%. (J.S.R.)

2782

QUANTITATIVE FLUORESCENCE X-RAY SPECTRAL ANALYSIS OF ORES AND MINERALS ON THE ELEMENTS U, Th, Pb, Ta, Hf, Nb, Zr, Y AND Sr. K. I. Narbutt and I. D. Bespalova. Zavodskaya Lab. 24, 617-19(1958).

An x-ray-spectroscopic method for the quantitative determination of U, Th, and Pb is extended to the determination of Ta, Hf, Nb, Zr, Y, and Sr. The method is described in detail. The accuracy is ±1%, and the sensitivity is from 0.05 to 0.3%. (J.S.R.)

2783

ON THE PROBLEM OF THE DETERMINATION OF BERYLLIUM BY MEANS OF ACID ALIZARIN BB. S. I. Barskaya and F. M. Shemyakin. Zavodskaya Lab. 24, 654(1958).

The method for the determination of beryllium with acid alizarin BB is discussed. The preparation of the test solutions and of the color scale required for the determination are described. (J.S.R.)

2784

INVESTIGATION OF RELAXATION PROCESSES IN SEVERAL FLUORINE COMPOUNDS OF CARBON. V. S. Grechishkin (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 364-6(1958) Aug. (In Russian)

A study is made of the influence of the tensor of chemical displacements on the relaxation time of fluorine nuclei. The theory is compared with experiment. It is found that the difference in the relaxation times of the fluorine nucleus and a proton in the same molecule depends on the presence of nuclei of a different halogen. (tr-auth)

2785

THE CATALYTIC PROPERTIES OF CERIUM DIOXIDE IN THE DEHYDROGENATION AND DEHYDRATION OF ALCOHOLS AND IN THE DEHYDROGENATION OF CYCLOHEXANE. A. A. Tolstopyatova and A. A. Balandin (Zelinskii Inst. of Organic Chemistry, Moscow). Zhur. Fiz. Khim. 32, 1831-41(1958) Aug. (In Russian)

The activation energies were determined for the dehydrogenation of methyl, ethyl, n-propyl, and iso-propyl alcohols and the dehydrogenation of cyclohexane, as well as of the dehydration of iso-propyl alcohol, over cerium dioxide prepared by precipitating cerium hydroxide from the nitrate. The bond energies of carbon, hydrogen, and oxygen with the catalyst have been calculated. The effects on these values of the alcohol structure were investigated. (tr-auth)

2786

THE HEAT CONTENT OF CORUNDUM IN THE TEMPERATURE RANGE FROM 100 TO 900°C. K. S. Gomelskii (Mendeleev All-Union Research Inst. of Metrology, Sverdlovsk). Zhur. Fiz. Khim. 32, 1859-62(1958) Aug. (In Russian)

Values were tabulated for the heat capacities and heat contents of α-Al_2O_3 (corundum) measured with the aid of isothermal jacketed calorimeters. The factors determining the accuracy of the measurements are indicated. (auth)

2787

A STUDY OF THE HYDROGEN OVERVOLTAGE ON GERMANIUM. E. A. Efimov and I. G. Erusalimchik. Zhur. Fiz. Khim. 32, 1967-70(1958) Sept. (In Russian)

The hydrogen overvoltage on p- and n-type monocrystalline germanium in 0.1 N HCl has been studied at 20°C and current densities ranging from 10^{-5} to 10^{-1} a/cm^2. Germanium was shown to be a metal with a high hydrogen overvoltage that was independent of the type of conductivity of the former. The conclusion was drawn that the process of hydrogen evolution on germanium takes place according to the retarded discharge mechanism. (auth)

2788

THE ANODIC DISSOLUTION OF METALS IN MOLTEN SALTS. II. BERYLLIUM. M. V. Smirnov and N. Ya. Chukreev (Academy of Sciences, USSR, Sverdlovsk). Zhur. Fiz. Khim. 32, 2165-73(1958) Sept. (In Russian)

The anodic efficiency was determined in the electrolysis of molten alkaline metal chlorides (LiCl + KCl eutectics) with a beryllium anode. In the region of low current densities (of the order of 10^{-3} a/cm^2) at 500°C it has been found that about a third of the beryllium passes over into the electrolyte as univalent ions. The polarization of the beryllium anode in the molten eutectic mixture of lithium and potassium chlorides was studied at 400, 500, 600, and 800° over a wide range of current densities, from 10^{-3} to 5 a/cm^2. The potential of the anode was shown to increase by 0.7 to 0.8 v. Below 0.01 a/cm^2 it is close to the potential of beryllium, established in the molten alkaline chloride melt without electrolysis, and is practically independent of the current density. Above 0.01 a/cm^2 it begins to increase with the current density i, a linear relation φ = const + RT/2F ln(i) being observed within the limits 0.01 to

0.1 a/cm^2. Further increase in the current density is accompanied by an abrupt increase in the anode potential to a value approaching the equilibrium potential of beryllium in a melt of its chloride. The introduction of fluorine ions into the melt was shown to shift the potential of the beryllium electrode strongly to the negative and to increase the diffusion current of dissolution due to overcharge of the alkaline metal ions. In mixed fluorine-chlorine melts the range of change in potential of the beryllium anode with current density (from 0.001 to 5 a/cm^2) broadens to 1.2 to 1.4 v. (tr.auth)

2789

CATHODIC PROCESSES IN THE DEPOSITION OF BERYLLIUM FROM MOLTEN ELECTROLYTES. M. V. Smirnov and L. E. Ivanovskii. Zhur. Fiz. Khim. 32, 2174-82(1958) Sept. (In Russian)

A study was made of the polarization of the molybdenum cathode at 400, 500, and 600°C in a molten eutectic of lithium and potassium chlorides containing 0.1, 1.9, and 7.25% by weight $BeCl_2$ or 3.9% by weight K_2BeF_4, the current densities ranging from 10^{-3} to 3 a/cm^2. The introduction of fluorine ions in the melt in amounts equivalent to K_2BeF_4 considerably increases the deposition potential of metallic beryllium on the cathode and lowers the limiting diffusion current of discharge of its ions, but has no significant effect on the overcharge of the alkaline metals at low current densities (in the region of residual current) nor on their deposition potential at high current densities. (tr-auth)

2790

SYMPOSIUM ON DETERMINATION OF GASES IN METALS. ASTM Special Technical Publication No. 222. Presented at the Sixtieth Annual Meeting Atlantic City, N. J., June 18, 1957 American Society for Testing Materials. Philadelphia, American Society for Testing Materials, 1958. 62p. $2.25.

Two apparatuses are discussed for the vacuum fusion determination of gases in metals. Methods for the analysis of various metals for gases by the vacuum fusion technique are discussed. A capillary trap method is presented for the determination of oxygen in metals using a platinum bath. The principles of the bromination-carbon reduction method for determining oxygen in metals are discussed. The problems encountered in extending emission spectrometric methods to the determination of the oxygen content of metals are surveyed, and several techniques for surmounting some of these problems are discussed. (W.L.H.)

2791

ORGANIC SYNTHESES WITH ISOTOPES. PART II. ORGANIC COMPOUNDS LABELED WITH ISOTOPES OF THE HALOGENS, HYDROGEN, NITROGEN, OXYGEN, PHOSPHORUS, AND SULFUR. Arthur Murray, III and D. Lloyd Williams. New York, Interscience Publishers, Inc., 1958. pp. 1147-2096.

The procedures are given for the preparation of labeled organic compounds. (W.L.H.)

Radiation and Radiochemistry

Refer also to abstract 3462.

2792 CF-58-12-23

Oak Ridge National Lab., Tenn.

CHEMICAL FEASIBILITY OF HOMOGENEOUS NEUTRON POISONS FOR CRITICALITY CONTROL IN FUEL REPROCESSING. J. G. Moore and R. H. Rainey. Dec. 1, 1958. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A preliminary examination has demonstrated the apparent chemical feasibility of the nuclear poisons boron, cadmium, and rare earth elements in the proposed flowsheet for reprocessing Consolidated Edison thorium reactor fuel. These elements remained in solution and were not volatilized to a significant extent during the feed adjustment step. In simulated dissolver solutions containing the poisons, 3% of the boron and less than 1% of the cadmium or rare earths were lost during boildowns. The solvent extraction of uranium with 2.5% TBP in Amsco from acid feed solutions containing sufficient nuclear poison to maintain a subcritical system, gave decontamination factors of 4,000, >500, and >3000 for boron, cadmium, and rare earths, respectively. Using acid deficient feed solutions, the corresponding factors were 9000, >1000, and >15,000. Single extraction cycles were made in which the concentrations of boron, rare earths, and cadmium in the uranium product were reduced to within the probable acceptable limits, i.e., 2.5 ppm, <4 ppm, and <17 ppm, respectively. (auth)

2793 NP-7104

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PREPARATION OF AQUEOUS SOLUTIONS OF $S^{35}O_2$ WITH CARRIER. Report No. 38/V. J. Falecki. Oct. 1958. 9p.

A micro-method was worked out for preparing dilute solutions of $S^{35}O_2$ with carrier. Chemical and radiochemical yields for the reaction were determined. (auth)

2794 NYO-6142

Brookhaven National Lab., Upton, N. Y. and Columbia Univ., New York.

CHEMICAL EFFECTS OF NEUTRON CAPTURE IN SOME COBALTIC HEXAMINES (thesis). Arvid V. Zuber. June 11, 1954. 75p. Contract AT(30-1)-1019. (CU-18-54-AEC-1019-Chem). $12.30(ph OTS); $4.50 (mf OTS).

The chemical effects of neutron capture in some cobaltic hexamines are presented. (W.L.H.)

2795 RME-3153

Isotopes, Inc., Westwood, N. J.

RADIOMETRIC ANALYSIS OF URANIUM CONTENT IN ORES. Paul E. Damon and Herbert W. Feely. July 31, 1957. 55p. Contract AT(49-6)-1159. $1.50(OTS).

A radiometric method is presented for the rapid determination of uranium content of ore. The method is valid regardless of the equilibrium state of the sample material. Uranium concentration is determined by direct measurement of the 0.093 Mev gamma ray of Th^{234} (UX_1), the first daughter of U^{238}. Resolution of this relatively low energy gamma ray, normally difficult because of the masking effects of the many other photons present, is accomplished by combining three devices: Copper absorbers to reduce, by absorption, the detection of gammas of energy less than 0.093 Mev. Thin (2 to 3 mm) NaI(Tl) scintillation crystal, to reduce the counting efficiency of higher energy gamma rays. Critical absorption by lead of the 0.093 Mev gamma ray (critical absorption edge = 0.090 Mev). Utilizing the copper absorbers and thin crystal, all gamma rays except those in the range of about 0.070 Mev to 0.120 Mev, are poorly detected. The very strong absorption by lead of

the 0.093 Mev gamma of Th^{234} may then be observed and related to the concentration of that isotope. Results indicate that a linear relationship exists between uranium content and the experimentally determined Th^{234} activity, as expected. The accuracy of the method for most samples with greater than 0.2% uranium content appears to be at least 20%. (auth)

2796

PRODUCTION OF WEIGHABLE AMOUNTS OF Tc^{99} BY NEUTRON IRRADIATION OF MOLYBDENUM. V. I. Spitsyn and A. F. Kuzina. Atomnaya Energ. 5, 141-6 (1958). (In Russian)

Various methods of technetium recovery from molybdenum anhydrides, irradiated by thermal neutrons in nuclear reactor, were studied. A method for technetium concentration and recovery was developed by coprecipitation of technetium with phosphate followed by chromatographic purification. The laboratory method succeeded in producing several milligrams of Tc^{99}. Spectral analysis was made for identification of the recovered technetium, and measurements were made of the absolute activity and its β-ray energy maximum. The chemical properties of technetium were studied. (tr-auth)

2797

INFRARED ABSORPTION SPECTRA OF URANYL HALOGENIDE ANHYDRIDES. Jacques Prigent. Compt. rend. 247 1737-9(1958) Nov. 17. (In French)

The preparation of anhydrous uranyl chloride and bromide and the determination of the infrared absorption spectra of samples carefully shielded from the air show that the anhydrous uranyl ion is linear. This conclusion agrees with that from x-ray-diffraction work. The results explain previous contradictions. (tr-auth)

2798

ANALYTICAL INSTRUMENTATION PROBLEMS IN RADIOCHEMICAL PROCESSES. Robert C. Axtmann (E. I. du Pont de Nemours & Co., Inc.). Control Eng. 6, 94-7(1959) Jan.

Some of the principal radiochemical processes, the variables to be measured and controlled, and problems encountered by instrument designers are discussed. (A.C.)

2799

RADIOACTIVE WATERS FROM SEDIMENTS. Stanko Miholić (Univ. of Zagreb). Geochim. et Cosmochim. Acta 14, 223-33(1958) Sept.

Determinations of radioactivity by measuring the radon content in a number of Yugoslav mineral waters have shown that their radioactivity depends on the geologic age of the sediments through which they are flowing. Those waters which issue from Carboniferous or Cretaceous strata show a distinctly higher radioactivity due to a higher content of uranium in those sediments. Part of the content in radioactive substances of the waters is deposited in sinters that sometimes accumulate around the springs. In those deposits uranium is, as a rule, not in radioactive equilibrium with its daughter elements. Particularly in cases of calcareous sinters and ochres there are generally more ionium and radium present than would correspond to the radioactive equilibrium. Only deposits from waters containing hydrogen sulphide contain mainly uranium. Water that passes through such sinters shows a greater radioactivity than the original water. The highest factor of enrichment (7.27) was found in the thermal water of Višegrad. (auth)

2800

THE SZILARD-CHALMERS EFFECT IN SOLID ETHYL BROMIDE. Miriam Milman (Nuclear Physics Group of the Ecole Normale Supérieure, Paris). J. Am. Chem. Soc. 80, 5592-5(1958) Nov.

The contribution of diffusion dependent reactions following radiative neutron capture by the bromine atom in solid ethyl bromide, has been investigated. The scavenger effect of elementary bromine and 1,2-dibromoethylene, as well as the influence of irradiation temperature and crystalline structure were examined. It was found that the high yield of radioactive organic species is due to a great enhancement of hot processes, the diffusion controlled reactions having a smaller relative importance than in the case of the neutron irradiation of liquid ethyl bromide. (auth)

2801

USE OF HYDROGEN ISOTOPE EFFECTS TO IDENTIFY THE ATTACKING NUCLEOPHILE IN THE ENOLIZATION OF KETONES CATALYZED BY ACETIC ACID. C. Gardner Swain, Edward C. Stivers, Joseph R. Reuwer, Jr., and Lawrence J. Schaad (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 80, 5885-93(1958) Nov. 5.

Catalysis of enolization by acetic acid is not due to an acetic acid molecule acting on the ketonic oxygen and a water molecule removing the proton from carbon, but instead to hydrogen ion acting on the ketonic oxygen and acetate ion removing the proton from carbon, in the case of α-phenylisocaprophenone (a ketone with one α-hydrogen) in aqueous solution with 8.4 M dioxane (72% dioxane by volume) at 100°. The magnitude of the protium/tritium isotope effect at the carbon is diagnostic of the attacking nucleophile, increasing as the basicity and reactivity of the nucleophile increases. For catalysis by acetic acid, it has a value (11.4) which is too high for nucleophilic attack by water, but correct for attack by acetate ion. A relation between tritium (k_H/k_T) and deuterium (k_H/k_D) isotope effects is derived and compared with experimental data. (auth)

2802

EFFECT OF PROTON IRRADIATION UPON HYDROGEN REDUCTION OF NiO. M. T. Simnad, R. Smoluchowski, and Aija Spilners (Carnegie Inst. of Tech., Pittsburgh). J. Appl. Phys. 29, 1630-2(1958) Dec.

It is shown that the reduction of a metal oxide such as nickel oxide by hydrogen gas is strongly influenced by nuclear irradiation. The initial induction period is shortened and the subsequent reduction accelerated. The effects anneal out at higher temperatures. A probable mechanism of this acceleration is suggested. (auth)

2803

RADIATION-INDUCED RECOMBINATION CENTERS IN GERMANIUM. O. L. Curtis, Jr., J. W. Cleland, and J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 29, 1722-9(1958) Dec.

An attempt has been made to provide a better understanding of minority carrier recombination processes in irradiated germanium. To this end, studies have been made of the minority carrier lifetime of both n- and p-type material, following fast neutron and Co^{60} γ irradiations. The effect of carrier concentration and temperature has been determined. The primary conclusion drawn from these investigations is that the recombination process is associated with an energy level

located 0.20 ev below the bottom of the conduction band. From measurements of the lifetime in n-type specimens, the hole capture cross section has been calculated and found to be $\sigma_p = 3 \times 10^{-15}$ cm^2 and $\sigma_p = 4 \times 10^{-16}$ cm^2 for neutron and γ-induced centers, respectively. If a second, lower lying level is associated with the second ionization of the defect responsible for recombination, then the effective number of recombination centers is reduced in p-type material as the Fermi level approaches the valence band, due to this ionization. Such a process is in qualitative agreement with the observed data. (auth)

2804

THE CHEMICAL EFFECT OF ALPHA PARTICLES ON URANIUM HEXAFLUORIDE. C. H. Shiflett, M. E. Steidlitz, F. D. Rosen, and W. Davis, Jr. (Union Carbide Nuclear Co., Oak Ridge, Tenn.). J. Inorg. & Nuclear Chem. 7, 210-23(1958) Oct.

Alpha-particle decomposition of uranium hexafluoride has been studied over the temperature range 26° to 87°C. Radiation was obtained by use of charges of about 0.1 c Rn-222. Products of the decomposition are fluorine and intermediate uranium fluorides; the products react with each other, apparently by a radiation-induced process, to re-form uranium hexafluoride. Reaction rates are independent of temperature over the temperature range studied. Average values of G_U and M/n are, respectively, 0.90 and 0.27, the latter being based on loss of 30 ev by an α-particle when it produces one ion pair. (auth)

2805

CORRELATION OF ABSORPTION SPECTRA AND PARTITION DATA FOR PLUTONYL NITRATE IN AQUEOUS AND ORGANIC MEDIA. T. V. Healy and A. W. Gardner (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 245-56(1958) Oct.

An examination of the absorption spectra of plutonyl nitrate in dibutyl carbitol shows the presence of two species, the dinitrate and the trinitrate, the latter being formed in the presence either of nitric acid or quaternary ammonium salts. The addition of tributyl phosphate to dibutyl carbitol solutions tends to suppress the trinitrate species. The trinitrate has a much higher partition coefficient than the dinitrate for extraction into dibutyl carbitol from aqueous nitric acid and nitrates. This improvement in the organic extraction obtained by raising the aqueous acidity is shown, by correlation with absorption spectra, to be directly related to the production of the trinitratoplutonyl species from the dinitrate. The association constant for the reaction $PuO(NO_3)_2 + HNO_3 = HPuO_2(NO_3)_3$ in the organic solvent has been obtained with a value of 4 ± 1. The relation of the plutonyl species present in the aqueous and organic phases is discussed. (auth)

2806

STUDIES ON PROTACTINIUM(V) IN NITRIC ACID SOLUTIONS. C. J. Hardy, D. Scargill, and J. M. Fletcher (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 257-75(1958) Oct.

Reproducible solutions less than 10^{-4} M in protactinium-231 in 1–12 M nitric acid have been prepared and examined. Extraction of Pa by tributylphosphate resembles that of zirconium and equilibrium is rapidly attained. The relative strengths of fluoro-complexing of Pa(V) and Th(IV) in nitric acid have been derived by similar extraction experiments. Distribution coefficients using butex, solutions of tri-n-octylamine and di(2-ethylhexyl) phosphoric acid in inert organic diluents, and cation and anion exchange resins have also been measured. The protactinium species in nitric acid are interpreted as a series of hydroxo-nitrato complexes. The adsorption of protactinium from these solutions on active solids and a comparison of thorium, uranium and protactinium exchange on ZeoKarb 225 and DeAcidite FF is also reported. (auth)

2807

ACIDIC ESTERS OF ORTHOPHOSPHORIC ACID AS SELECTIVE EXTRACTANTS FOR METALLIC CATIONS, TRACER STUDIES. D. F. Peppard, G. W. Mason, W. J. Driscoll, and R. J. Sironen (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 7, 276-85 (1958) Oct.

The extraction of Sc(III), Y(III), La(III), Ac(III), Pm(III), Tm(III), and Am(III) into solutions of $(GO)PO(OH)_2$ and $(GO)_2PO(OH)$ in toluene as carrier solvent from aqueous mineral acid phases have been investigated as a function of solvent concentration in the organic phase, hydrogen ion concentration in the aqueous phase, the nature of G, and the position of M(III) in the periodic table, using the radioactive-tracer technique. The distribution ratio, K, defined for a given radioactive nuclide as its concentration in the organic phase divided by its concentration in the aqueous phase, has been found, for all of the M(III) examples studied, to have an inverse third-power dependency upon the hydrogen ion concentration in the aqueous phase in both the $(GO)PO(OH)_2$ and $(GO)_2PO(OH)$ systems. The solvent dependencies have been found to be direct first-power in the $(GO)PO(OH)_2$ systems and direct third-power in $(GO)_2PO(OH)$ systems. Since the $(GO)_2PO(OH)$ solvents have been shown to be dimeric, the extracted species is postulated as $M^{III}\{H[(GO)_2PO_2]_2\}_3$. The $(GO)PO(OH)_2$ solvents have been shown to be polymeric. A postulated "dimer" mechanism of extraction suggests that the extracted species is $M^{III}\{H[(GO)PO_3H]_2\}_3$. However, an alternative suggested "infinite polymer" mechanism of extraction seems equally likely. Specifically, solvents in which G is 2-ethyl hexyl, symbolized as EH, and para(1,1,3,3-tetramethyl butyl)phenyl, symbolized as Oϕ, have been investigated. In both the $(GO)PO(OH)_2$ and $(GO)_2PO(OH)$ systems the Oϕ solvent shows a higher K than the EH solvent. In the Oϕ systems, the K_S (an empirical stability constant) for the di-ester is higher than that for the mono-ester for each of the members of the vertical group Sc, Y, La, Ac. In the EH systems, the K_S for the di-ester is the larger for Sc by a factor of approximately 30 and the smaller for Ac by a factor of approximately 10^{-5}. In all the systems the K (and K_S) values are compressed toward the bottom of the group in the vertical group, Sc, Y, La, Ac, i.e., the ratio of the K (or K_S) of one element to that of the element immediately below it decreases downward. (auth)

2808

THE PREPARATION OF A SOLUTION OF PLUTONIUM(V) IN 0·2 M HNO_3. T. L. Markin and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 298-9(1958) Oct.

A solution containing plutonium in the pentavalent state only has been prepared by mixing equal concentrations of Pu(III) and Pu(VI) in 0.2 M HNO_3 in the presence of dibutyl phosphate in benzene. The equilibrium for the

following reaction is rapidly attained: Pu(III) + Pu(VI) ⇌ Pu(IV) + Pu(V) and may be shifted to the right by removal of Pu(IV) by the organic solvent. A solution of Pu(IV) (2 mg/ml) in 0.2 M HNO_3 solution was divided into two equal portions. One portion was oxidized electrolytically to Pu(VI) and the second portion was reduced by sulfur dioxide gas to Pu(III). Excess SO_2 was removed by bubbling nitrogen through the solution for 3 hr. Pu(III) and Pu(VI) were mixed together and stirred in the presence of 0.1% D.B.P. in benzene. Pu(IV) was extracted into D.B.P. leaving Pu(V) in the aqueous phase. There was a tendency towards emulsion formation in the aqueous phase but this was overcome by decreasing the rate of stirring. The extraction of Pu(IV) was completed in 15 min. Spectrophotometric measurements using a Hilger Uvispek Spectrophotometer showed that only Pu(V) existed in the aqueous phase. The disproportionation of Pu(V) in 0.2 M acid solution is slow and no other valency of plutonium in the aqueous phase was observed during the spectrophotometric measurements. An aqueous solution of Pu(V) has also been obtained by extraction of Pu(IV), formed in the equilibrium reaction, into 0.07% D.B.P. in dibutyl ether. A cloudiness appeared in the aqueous phase after several hours, probably due to some dibutyl ether remaining in this phase and undergoing decomposition to peroxides. The preparation of a solution of Pu(V) by the extraction of Pu(IV) into T.T.A. was investigated but the extraction is slower than into D.B.P. and an observable disproportionation of Pu(V) in the aqueous phase had occurred by the time spectrophotometric measurements were made. (auth)

2809

THE SZILARD-CHALMERS REACTION IN SOLIDS. PART I. CHEMICAL EFFECTS OF NUCLEAR RECOIL. Garman Harbottle and Norman Sutin (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 62, 1344-51(1958) Nov.

A model is proposed to explain the chemical effects of nuclear recoil in solids. It is based upon the Seitz and Koehler treatment of the slowing-down of energetic atoms and makes use of the concept of the displacement spike. Although the model starts from physical considerations, it postulates specific chemical reactions during the lifetime of the displacement spike. The approach is compared with that of other workers and important differences are shown. (auth)

2810

CHEMICAL EFFECTS OF THE NUCLEAR TRANSFORMATION $C^{12}(n,2n)C^{11}$ IN BENZENE. INFLUENCE OF PHASE, TEMPERATURE AND RADICAL SCAVENGERS. B. Suryanarayana and Alfred P. Wolf (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 62, 1369-73(1958) Nov.

The distribution of carbon-11 activity in the products resulting from the (n,2n) activation of carbon-12 in benzene was studied. The $Li^7(d,n)Be^8$ reaction using cyclotron deuterons was used as the source of fast neutrons. A synthesis product, toluene-C^{11}, was isolated by carrier methods. The labeled benzene and toluene fractions were separated and purified by gas–liquid partition chromatography (g. l. c.). About 4.5 and 2.2% of the total activity produced were accounted for in benzene and toluene, respectively. Added radical scavengers decreased the activity as benzene-C^{11} but did not significantly affect the formation of toluene-C^{11}. Change of phase from liquid to solid had the same effect. The activity as benzene-C^{11} increased with decrease in temperature in the solid state. The results are discussed in the light of the current hypotheses on the chemical effects of nuclear transformations. Chemical mechanisms are considered for the formation of toluene-C^{11}. The present results also are compared with the results of the study of $N^{14}(n,p)C^{14}$ reaction in benzene. (auth)

2811

MECHANISM OF REACTION OF RECOIL HYDROGEN IN THE GAS PHASE. Mostafa Amr El-Sayed, Peder J. Estrup, and Richard Wolfgang (Yale Univ., New Haven). J. Phys. Chem. 62, 1356-63(1958) Nov.

The interaction of high energy tritium (H^3), formed by nuclear recoil, with gaseous methane and ethane, has been investigated under a wide variety of conditions. In the case of methane, a number of labeled products, chiefly HT and CH_3T, together with smaller amounts of higher tritium labeled hydrocarbons are formed. If a radical scavenger, such as I_2, is present, the yield of CH_3T is little changed, but the amount of HT is halved and the higher hydrocarbons eliminated. These results are not consistent with present theories of the mechanism of the primary step of hot-atom reaction. An alternative hypothesis that reactions of gas phase hot "atoms" are really due to ions does not appear tenable in the case of recoil tritium. A mechanism involving a high energy one-step displacement reaction as the primary reaction of the hot atom is suggested. Some of the labeled products of this primary reaction reach thermal energies as radicals which will then undergo further secondary reaction. Unlike the primary hot reactions, these thermal secondary processes are sensitive to the addition of radical scavengers. Evidence for this mechanism is obtained from a consideration of the detailed product distributions and their changes when certain experimental conditions, such as radiation intensity, are varied. Particularly significant are the consequences of the addition of a large excess of He^4 to moderate the hot atoms. A review of earlier data makes it appear probable that the primary hot replacement mechanism thus indicated for the gas phase reaction of recoil tritium is also operative in the condensed phase. The further extension of this mechanism to hot atom reactions in general is briefly discussed. (auth)

2812

EFFECT OF RECOIL ENERGY ON THE CHEMICAL CONSEQUENCES OF NUCLEAR ACTIVATION PROCESSES. ACTIVATION OF SOLUTIONS OF IODINE IN HYDROCARBONS. Charles E. McCauley and Robert H. Schuler (St. Peter's Coll., Jersey City, Brookhaven National Lab., Upton, N. Y., and Mellon Inst., Pittsburgh). J. Phys. Chem. 62, 1364-8(1958) Nov.

Comparative studies of the chemical consequences of activation of the halogens by the (n,γ) and (n,2n) processes have been extended to solutions of iodine in hydrocarbons. In contrast to the alkyl iodide system where no difference in chemistry between the two modes of activation was observed, (n,2n) activation results in this case in an appreciably higher organic yield. The observed increase in organic activity is attributed to the greater local disruption caused by the more energetic recoil atoms. (auth)

2813

CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS IN THE GAS PHASE. J. B. Evans, J. E. Quinlan, M. C. Sauer, Jr., and J. E. Willard (Univ. of Wisconsin, Madison). J. Phys. Chem. 62, 1351-5(1958) Nov.

Atoms activated by the (n,γ), (n,p) or I.T. processes can react with gaseous organic molecules in unique bimolecular displacement processes. Such reactions of Cl^{38}, Br^{80}, I^{128} and H^3 are summarized, new evidence is presented, and problems of mechanism are discussed. A search for a bromine isotope effect dependent on the difference in charge with which Br^{80m}, Br^{80}, and Br^{82} are born from the (n,γ) process is described. (auth)

2814

STUDIES OF THE RECOIL TRITIUM LABELING REACTION. V. FURTHER REACTIONS WITH GLUCOSE. Howard Keller and F. S. Rowland (Univ. of Kansas, Lawrence and Princeton Univ., N. J.). J. Phys. Chem. 62, 1373-7(1958) Nov.

Energetic tritium atoms reacting with glucose molecules in the condensed phase show variations in the percentage of total tritium bound to carbon in the otherwise unchanged glucose molecule, and in the percentage found in each individual position in the molecule. Less than 0.03% of the total tritium is found as labeled galactose in irradiated crystalline glucose. Most of the tritium is present as labile activity in irradiated glucose solution; about 1% is found as labeled glucose. (auth)

2815

THE ATOMIC AND MOLECULAR CONSEQUENCES OF RADIOACTIVE DECAY. Arthur H. Snell and Frances Pleasonton (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 1377-82(1958) Nov.

Magnetic analysis of ions produced by radioactive decay of gases at low pressure reveals varied atomic and molecular effects. In atoms, β-emission alone usually causes no self-ionization, but sometimes the nuclear charge change shakes off an electron, most frequently from an outer shell. Eleven per cent of the decays of Kr^{85} (9.4 y) initiate shakeoff of a 4s or 4p electron, and a further 10% cause self-ionization from deeper shells. Internal conversion and electron capture initiate vacancy cascades (successive Auger transitions) sometimes yielding high multiple ionization. In the isomeric transition of Xe^{131}(12d) with no change in nuclear charge, 21% of the internal conversions cause removal of 8 electrons, only 0.62% yield the conversion electron alone, and 20 electrons are ejected in 0.003% of the decays. Complex decay schemes (Kr^{79}, Xe^{133}) yield other patterns. In molecules, pure β-emission frequently fails to dissociate; examples are TH and $C^{14}O_2$, which remain bound as $(He^3H)^+$ and $(NO_2)^+$ following, respectively, 93 and 81% of the decays. When dissociation does occur in TH, the electrons usually go one with each fragment despite energetic unfavorability, suggesting that the predominantly covalent configuration persists as the nuclei separate. In $C^{14}O_2 \rightarrow (NO_2)^+$, dissociation yielding $(NO)^+$, O^+, and N^+ follows, respectively, 8.4, 5.9, and 3.6% of the decays. In CH_3T, the predominant process is one in which neutral He^3 separates, leaving CH_3^+. Less frequently, hydrogens are also split off, leaving CH_2^+, CH^+, or C^+. (auth)

2816

DISSOCIATION OF C_2H_5T AND 1,2-$C_2H_4BrBr^{82}$ BY β-DECAY. Sol Wexler and David C. Hess (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 62, 1382-9(1958) Nov.

The patterns of positively charged fragments of monotritiated ethane resulting from β-decay of H^3 and of 1,2-dibromoethane from β-γ emission of Br^{82} have been measured in a specially designed mass spectrometer. The results are discussed in terms of the statistical model involving successive, thermal, unimolecular decompositions. An estimate is made of the molecular excitation energy available from the β-transformation of tritium in C_2H_5T. (auth)

2817

DIFFUSION PROCESSES IN POLYMERS UNDER IRRADIATION; POLYVINYL ALCOHOL AND CCl_4 SYSTEM. Tsutomu Watanabe (Univ. of Tokyo). J. Phys. Soc. Japan 13, 1316-24(1958) Nov.

When the PVA film is irradiated in CCl_4, PVA is swollen and cross-linked. A Phenomenological theory is proposed for this experiment. The processes are considered that with the change of diffusion constant CCl_4 enters into PVA as the radiation dose increases, and the radicals from CCl_4 react upon PVA and cause crosslinking. The results of calculation agree reasonably with experiments, that is, the weight changes of swollen polymers against the total dose, the gel fraction changes and the viscosity average molecular weight changes in sol fractions against the total dose. Other various mechanisms that can be considered are discussed. (auth)

2818

ELEMENTARY ANALYSIS USING RADIATION SOURCES. J. S. Wiberley (Socony Mobil Oil Co., Brooklyn). Microchem. J. 2, 219-27(1958) Nov.

The growing importance of the use of analytical radiation techniques in industrial laboratories is discussed. Primary emphasis is placed on the use of radioactive sources in the determination of elements in organic compounds, particularly petroleum products. Examples cited include the determination of S by use of radiation from Fe^{55} and the determination of hydrogen by the use of Sr^{90}. Also, the application of the use of neutron-activated sources in the determination of rock composition in oil drilling operations is discussed. (T.B.A.)

2819

ISOTOPIC ANALYSIS: CERIUM-141 AND CERIUM-144. W. S. Lyon (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 4, 709-12(1958) Dec.

Cerium-141 and cerium-144 are determined in the presence of each other by performing a suitable cerium chemical separation and then measuring the radiation from each nuclide. Cerium-144 is determined by counting the 3.0-Mev Pr^{144} beta ray; cerium-141 is determined by integrating beneath the 145-kev gamma-ray peak observed with a sodium iodide gamma-ray spectrometer. In the later case correction for contributions from cerium-144 must be made. The gamma/beta branchings for the 145-kev gamma ray in cerium-141 and the 134-kev gamma ray in cerium-144 were determined. (auth)

2820

ON THE MASS MEASUREMENTS IN G-5 AND K-5 EMULSIONS. L. Ciuffolotti, G. Luzzatto, G. Tomasini (Istituto di Fisica dell'Universita, Genoa and Istituto Nazionale di Fisica Nucleare, Genoa) and G. Cortini (Istituto di Fisica dell'Universita, Catania and Centro Siciliano di Fisica Nucleare, Catania). Nuovo cimento (10) 9, 1110-13(1958) Sept. 16.

Ionization measurements were made in order to analyze the new K-5 Ilford emulsions. A total of 2,480 cells of 40 μm length were measured. The K-5 plates had been exposed to 150 Mev protons and to 38 Mev mesons. Results are shown in tabular and graphical form. (J.H.M.)

2821

CORRECTIONS FOR α PARTICLE SELF ABSORPTION IN MEASURING THE ACTIVITIES OF FLAT SPECIMENS. D. P. Osanov and V. I. Popov (Moscow Inst. of Engineering Physics). Pribory i Tekh. Ekspt. No. 5, 32-4(1958) Sept. (In Russian)

Corrections were introduced for the α particle self-absorption. A curve was plotted for the α yield from a flat specimen and the thickness of a specimen. This permitted the determination of the magnitude of the α particle path in the specimen as well as corrections for self-absorption of specimens with arbitrary thickness. The derived formulas and curves can be used in determining the α impurities in water and in other practical calculations. (tr-auth)

2822

ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE TO PROTEINS. Walter Gordy and Howard Shields (Duke Univ., Durham, N. C.). Radiation Research 9, 611-25(1958) Dec.

Electron spin resonance of free radicals produced by x irradiation of various types of proteins has been observed. Generally, only two types of resonance pattern were observed, either separately or in combination. One of these patterns is field-dependent and characteristic of cystine or cysteine, and the other is a doublet similar to that of irradiated polyglycine. Effects of orientation of the sample in the applied magnetic field were observed for silk and feather quill. The total spread of the cystinelike resonance depends on the strength of the applied magnetic field or the frequency at which the resonance is observed. Effects of absorbed oxygen were noted for several samples. The double resonance is converted by O_2 to a relatively sharp but field-dependent resonance believed to arise from a peroxide radical, ROO, formed by combination of molecular oxygen with radicals originally produced by the x irradiation. The cystinelike resonance is killed by O_2 without the production of an observable secondary radical. (auth)

2823

RADICAL YIELD MEASUREMENTS IN IRRADIATED AQUEOUS SOLUTIONS. II. RADICAL YIELDS WITH 10.9-Mev DEUTERONS, 21.3- AND 3.4-Mev ALPHA PARTICLES, AND B(n,α) Li RECOIL RADIATIONS. N. Miller (Argonne National Lab., Lemont, Ill.). Radiation Research 9, 633-46(1958) Dec.

Solutions containing ferric sulfate, cupric sulfate, and formic acid in 0.01 N sulfuric acid have been irradiated with ionizing radiations of high LET, and the yields of products measured. Information has thus been obtained concerning the effect on the yield of free H and OH radicals of increasing concentration of radical scavengers, and increasing LET of the incident radiation. Measurements have also been carried out of the yield of ferric ion in aerated and deaerated ferrous sulfate solutions in 0.01 N and 0.8 N sulfuric acid, induced by similar types of radiation. Striking departures are observed from the predictions of simple theories based on homogeneous kinetics which have proved adequate in interpreting the effects of γ-rays on the same systems. It is concluded that with radiations of high LET even the secondary stages of the reaction mechanism take place in track zones in which the concentrations of the intermediate chemical species are changing rapidly with time. (auth)

2824

SYNTHESIS OF PRODUCTS OF HIGHER MOLECULAR WEIGHT IN THE RADIOLYSIS OF AQUEOUS SOLUTIONS OF FORMIC ACID. Warren M. Garrison, Winifred Bennett, and Sibyl Cole (Univ. of California, Berkeley). Radiation Research 9, 647-59(1958) Dec.

Irradiation of dilute, oxygen-free formic acid solutions with cyclotron-produced protons or helium ions leads to the synthesis of a number of products of higher molecular weight. The compounds identified include oxalic, glyoxylic, glycolic, mesoxalic, tartronic, and tartaric acids, and glyoxal. These products are not formed in appreciable yield by neutron (and γ-ray) irradiation. The observations are correlated in terms of a reaction mechanism that involves dose rate-dependent steps. (auth)

2825

FORMATION OF METAL ALKYLS BY IONIZING RADIATION. Russell H. Johnsen and Robert C. Gabler (Florida State Univ., Tallahassee). Science 128, 1510-11(1958) Dec. 12.

It has been demonstrated that liquid hydrocarbons, under the influence of gamma radiation, react with high-surface sodium to form metal alkyls. The nature of these metal alkyls has been determined, and possible mechanisms for their formation are discussed. (auth)

2826

THE ACTION OF IONIZING RADIATION ON AQUEOUS POTASSIUM NITRATE SOLUTIONS. A. M. Kabakchi, V. A. Gramolin, and V. M. Erokhin (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim. 32, 2149-54(1958) Sept. (In Russian)

The effect of the gamma radiation of Co^{60}, the beta radiation of P^{32}, and the alpha radiation of Pu^{239} on aqueous potassium nitrate solutions was investigated. The salt concentration in the solution varied within the limits of 0.01 to 2 M. It has been found that the radiation yield of nitrite ion significantly increases with the concentration of the salt. Thus for the gamma radiation the nitrite ion/yield in 0.01 M solution was found to be equal to 0.53, whereas, in 2 M it was 4.5 ions per 100 ev. For the alpha radiation it was, respectively, 0.2 and 3.4 ions per 100 ev. On the basis of the results obtained it may be suggested that the increase in nitrate ion yield in concentrated solutions as compared with dilute solutions greatly depends upon the solute concentration and little upon the change in ionization density. (tr-auth)

2827

METODY OPREDLENIYA RADIOAKTIVNYKH ELEMENTOV V MINERAL'NOM SYR'YE. (Methods of Determining Radioactive Elements in Mineral Raw Materials.) V. G. Sochevanov, V. I. Titov, comps., N. E. Krasnova and T. A. Averkiyeva, eds. Moscow, Gosgeoltekhizdat, 1958. 68p.

The chemical determination of radioactive substances in minerals and rock formations is described. The chemical treatment of materials in preparation for radiometric analysis is also included. Methods are given for uranium, radium, and thorium. (J.S.R.)

2828

NUCLEAR CHEMISTRY. J. H. de Boer, A. H. W. Aten, Jr., E. Havinga, and M. E. A. Hermans. Gravenhage, Netherlands, Reactor Centrum Nederland, 1958. 110p. (In Dutch)

A short historical survey is presented of the development of the concepts of nuclear chemistry, such as the

atom, isotope, and the primary components of the nucleus. The inorganic aspects of nuclear chemistry, such as the discovery of artificial isotopes, tracer studies, activation analysis, and the Szilard-Chalmers processes, are discussed. The scope of the applications of isotopes in organic chemistry is illustrated by some examples. The technical application of nuclear chemistry to the breeding ratio of reactors and fuel and construction material processing is considered. (J.S.R.)

Separation Processes for Pu and U

2829 AERE-CE/M-227

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFICIENCY OF HYDRAULIC CYCLONES FOR HOMOGENEOUS AQUEOUS REACTOR FUEL PROCESSING. D. Bradley. Aug. 1958. 17p. $0.49(BIS).

Available data on the use of the hydraulic cyclone for the separation of solid corrosion and fission products from the HAR fuel solution are reviewed. These data are compared with the results of recent work at AERE to give detailed prediction of the performance of such a cyclone system. (auth)

2830 CF-52-11-82(Del.)

Oak Ridge National Lab., Tenn.

PILOT PLANT RADIOACTIVE GAS SEPARATION PROCESS EQUIPMENT AND OPERATING INSTRUCTIONS. W. B. Watkins, W. L. Poe, and D. R. Lindow. Nov. 12, 1952. Decl. with deletions Nov. 21, 1958. 45p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30 (mf OTS).

The purpose of the Radioactive Gas Separation Process (RAGS) is to remove radioactive elements, particularly krypton-85, from the gas evolved during the dissolution of irradiated fuel units. The process was developed by the ORNL Chemical Development and Unit Operations Sections and Linde Air Products Co., and was then installed in the ORNL pilot plant to confirm the feasibility of the laboratory flowsheet and to secure sufficient data to support an economic study of a plant scale installation. The process was operated in three distinct phases; first, the dissolver off-gas was continuously processed through the entrainment separator, condenser, iodine tower, filter, acid tower, and into the gas holder. Second, the gas was continuously processed through the caustic scrub tower, alumina dryer, cold trap, and silica gel adsorption unit. Finally, the krypton and xenon were desorbed from the silica gel bed and stored. The off-gases from 24 dissolvings were processed through the equipment. The adsorption of radioactive krypton on silica gel at −183°C was demonstrated in six successive runs. (auth)

2831 CF-57-9-73

Oak Ridge National Lab., Tenn.

DAREX FLOWSHEET (BATCH OPERATIONS). Walter E. Clark. Sept. 18, 1957. Decl. Nov. 28, 1958. 10p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

A complete Darex flowsheet is presented which represents an interim flowsheet since continuous operation will prove to be advantageous. (auth)

2832 CF-58-11-106

Oak Ridge National Lab., Tenn.

DEVELOPMENT OF BATCHWISE AND SEMI-CONTINUOUS DAREX FLOWSHEETS USING 61 WT PER CENT HNO_3. F. G. Kitts and B. C. Finney. Nov. 19, 1958. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80 (mf OTS).

Both batch-wise and semi-continuous Darex flowsheets were developed on a 1.4-liter scale using 61 wt. % nitric acid to volatilize and/or decompose chloride. The 61% acid is favored over higher concentrations for safety and availability. The batch flowsheet features simplicity and ease of operation; either batch or continuous dissolution can be used. The semi-continuous scheme, which assumes continuous dissolution, offers reduced cycle times but more complex operation. Both flowsheets accomplish chloride removal to <350 ppm by adding batch-wise only the amount of nitric acid required for solvent extraction feed adjustment and regeneration of dissolvent. (auth)

2833 DP-318

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

REPROCESSING OF POWER REACTOR FUELS. Second Quarterly Progress Report [for] January 1 to April 1, 1958. E. S. Occhipínti, comp. Sept. 1958. 8p. Contract AT(07-2)-1. $0.50(OTS).

A zirconium-clad alloy containing 90 wt. % uranium and 10 wt. % molybdenum can be dissolved in nitric acid containing low concentrations of fluoride ion. Uranium was extracted satisfactorily from a typical dissolver solution by a solvent of 10% tributyl phosphate in "Ultrasene," but further work will be required to extract plutonium satisfactorily. (auth)

2834 ORNL-2490

Oak Ridge National Lab., Tenn.

DEVELOPMENT OF THE EXCER PROCESS. IV. CHLORIDE SYSTEM. I. R. Higgins, W. J. Neill, and L. E. McNeese. Dec. 3, 1958. 49p. Contract W-7405-eng-26. $1.50(OTS).

An Excer flowsheet for the recovery of uranium from a chloride system by anion exchange is presented. Ore concentrate is dissolved in HCl, purified by anion exchange, electrolytically reduced to uranium tetrachloride, and then precipitated as hydrated uranium tetrafluoride by the addition of HF. The hydrated uranium tetrafluoride is filtered, dried, pelletized, granulated, and then dehydrated in a fluidized-bed dehydrator at 450°C. In the anion exchange purification step decontamination factors of greater than 10^3 are realized for all impurities except trivalent iron, pentavalent vanadium, and molybdenum. These three impurities are removed in the uranium tetrafluoride precipitation step with a decontamination factor of 10^3. In an evaluation, three kilogram batches of Excer uranium tetrafluoride were bomb-reduced to the metal. The first and second runs were reduced as received, and reduction yields of 0 and 14% were obtained. The third batch was ball-milled for 24 hours, improving its blendability with the magnesium reductant, and a yield of 76% was obtained. (auth)

2835 ORNL-2615

Oak Ridge National Lab., Tenn.

THE RECOVERY OF URANIUM FROM SULFATE SOLUTIONS BY SOLVENT EXTRACTION WITH TRIBUTYL PHOSPHATE. J. R. Flanary and J. H. Goode. Dec. 3, 1958. 15p. Contract W-7405-eng-26. $0.50(OTS).

Laboratory data and a process chemical flowsheet are given for the recovery of uranium from aqueous sulfate solutions by solvent extraction with tributyl phosphate. Uranium may be recovered from solutions containing as much as 2.5 moles of sulfate per mole of uranium by

adding sufficient nitrate-ion salting strength, in the form of aluminum nitrate and nitric acid, to overcome the complexing effect of the sulfate. The use of 15 moles of nitrate per mole of sulfate permitted essentially complete extraction of uranium in about 2.5 theoretical stages. Gross β and gross γ decontamination factors of 1×10^5 and 2.43×10^3, respectively, were obtained during processing of the uranyl sulfate core of the Raleigh Research Reactor; uranium losses were 0.008%. (auth)

2836

SEPARATION OF URANIUM FROM DIVERSE IONS. METHYL ISOBUTYL KETONE LIQUID-LIQUID EXTRACTION SYSTEM. William J. Maeck, Glenn L. Booman, Maxine C. Elliott, and James E. Rein (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem. 30, 1902-7(1958) Dec.

A liquid-liquid extraction procedure for the separation of greater than 99.8% of uranium(VI) from complex mixtures with one-batch contact is described. It is based on the extraction of tetrapropylammonium uranyl trinitrate with methyl isobutyl ketone from an acid-deficient aluminum nitrate solution. Because 1-year-cooled fission products extract less than 1%, this procedure is especially suitable for separation of uranium from reactor fuel element reprocessing solutions prior to its analytical determination. Per cent extraction for 49 cations at mole ratios of 10 to 1, 1 to 1, and 0.1 to 1 to uranium have been determined. The effects of 30 anions on the extraction of both uranium and fission products have been established. (auth)

2837

HYPOPHOSPHOROUS ACID AS A GRAVIMETRIC REAGENT FOR SCANDIUM. Donald R. Bomberger (Univ. of California, Livermore). Anal. Chem. 30, 1907-8 (1958) Dec.

During a search for a more specific gravimetric determination of scandium, it was found that hypophosphorous acid produced a weighable precipitate of scandium hypophosphite. A low gravimetric factor, combined with some improvement in selectivity over existing methods, indicated a useful reagent. The granular precipitate was easily transferred, washed, and dried. Quantitative recovery was obtained in the range from 0.1 to 1.0 mmole of scandium. (auth)

2838

ION EXCHANGE SPECTROGRAPHIC METHOD FOR DETERMINATION OF IMPURITIES IN URANIUM AND PLUTONIUM. James K. Brody, John P. Faris, and Robert F. Buchanan (Argonne National Lab., Lemont, Ill.). Anal. Chem. 30, 1909-12(1958) Dec.

An investigation was undertaken to provide a method for determining plutonium without the hazards and the elaborate glove box facilities required for the carrier distillation procedure. The new method gives results comparable to the latter method but with sensitivities an order of magnitude better for many elements. As more plutonium becomes available for reactor and research purposes, the determination of its purity will be greatly facilitated by the method. (auth)

2839

PLANT-TYPE POLAROGRAPHIC SYSTEM FOR DETERMINING URANIUM IN RADIOACTIVE WASTE STREAMS. G. J. Alkire, Karl Koyama, K. J. Hahn, and C. E. Michelson (General Electric Co., Richland, Wash.). Anal. Chem. 30, 1912-15(1958) Dec.

An industrial-type polarographic system has been developed for the automatic determination of uranium in radioactive process solutions. The equipment is designed for in-line use and records the uranium concentration in the range from 10^{-4} to 10^{-2} M every $7\frac{1}{2}$ minutes. The instrument has been used for nearly a year in pilot plant operation and is considered suitable for use in highly radioactive streams in processing plants. The detection of other constituents, off-standard process conditions, and material affecting the precision are discussed. (auth)

2840

LIQUID SCINTILLATION COUNTING OF RADIOACTIVE SULFURIC ACID AND OTHER SUBSTANCES. Norman S. Radin and Rainer Fried (Northwestern Univ. Medical School and Veterans Administration Research Hospital, Chicago). Anal. Chem. 30, 1926-8(1958) Dec.

A method is described for the determination of sulfur-35 in large amounts of sulfuric acid using a liquid scintillation counter. The acid is converted to a neutral salt of a high molecular weight aliphatic primary amine and is dissolved in toluene–ethyl alcohol. The efficiency of counting is almost independent of the amount of sulfate, but does depend on the amount of amine. Other acids, such as radioactive citric, phosphoric, and hydrochloric acids can be counted by this technique. Preliminary findings on the counting of monosaccharides are presented also. (auth)

2841

APPLICATION OF CALCIUM FLUORIDE IN SEPARATION OF SIGNIFICANT QUANTITIES OF LANTHANIDES FROM PLUTONIUM. P. M. Aron. Atomnaya Energ. 5, 183-5(1958). (In Russian)

Coprecipitation of rare-earth elements, from Pu^{239} fission, with calcium fluoride was carried out in the presence of Ag_7NO_{11}. The segregation of lanthanides from plutonium by single coprecipitation with calcium fluoride can be improved by repeated precipitation of fluorides. Double precipitation leaves 99.92% of the initial quantity of plutonium in solution, while the residue retains practically the total activity related to europium. Coprecipitation of lanthanides with calcium fluorides in the presence of Ag_7NO_{11} can be used not only for mass spectroscopic determinations of fission fragment yields, but, in combination with precipitation of lanthanides with ferric hydroxide, followed by iron extraction with ether, the fluoride coprecipitation leads to lanthanide recovery from the irradiated plutonium without any macrocarrier. (R.V.J.)

2842

RECOVERING URANIUM FROM UNIRRADIATED FUEL ELEMENT SCRAP. G. R. Jasny, J. R. Barkman, T. P. Sprague, and R. P. Smith (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Ind. Eng. Chem. 50, 1777-80(1958) Dec.

The following information is presented on the recovery of unirradiated fuel element scrap: solution techniques for U–Zr, U–stainless steel, and U–Al alloy scrap and the recovery of enriched uranium by dibutyl carbitol extraction, with 99.9% over-all efficiency. A summary flowsheet of the over-all enriched uranium scrap dissolving and purification process is shown. Schematics are included of the caustic dissolution process used on U–Al alloy scrap and the dibutyl carbitol process used to remove and purify uranium from various uranium alloy dissolver solutions. (J.H.M.)

2843

URANIUM RECOVERY FROM MAGNESIUM FLUORIDE

SLAG. CARBONATE LEACHING. R. G. Werkema and G. P. Lang (Mallinckrodt Chemical Works, St. Charles, Mo.). Ind. Eng. Chem. 50, 1781-4(1958) Dec.

Information is presented on the following basic steps in the carbonate leaching process: grinding the slag to expose uranium included in slag crystals; air roasting the slag to oxidize the uranium to U_3O_8; leaching the slag with a carbonate–bicarbonate solution containing an oxidant to convert the U_3O_8 to the soluble uranyl tricarbonate complex; further grinding the slag in part of the leaching circuit to complete the quantitative exposure of uranium to the leach solution; washing the leached slag cake to remove residual soluble uranium; and caustic precipitation of the uranium from slag-free leach liquor. Work on this process indicates that under the proper grinding, roasting, and leaching conditions, the uranium content of magnesium fluoride slag can be reduced to less than 0.05% on a dry basis and that a uranium concentrate can be obtained which is sufficiently low in fluoride to be suitable as refinery feed material. (J.H.M.)

2844

COMPUTATION OF THE PERFORMANCE OF A MULTICOMPONENT SOLVENT EXTRACTION SYSTEM. THE SEPARATION OF URANIUM AND PLUTONIUM FROM FISSION PRODUCTS BY TRIBUTYL PHOSPHATE. J. T. Wood and J. A. Williams (United Kingdom Atomic Energy Authority, Windscale Works, Cumb., Eng.). J. Brit. Nuclear Energy Conf. 3, 315-28(1958) Oct.

Established methods of graphical calculation for immiscible phases are applied to a complex multicomponent solvent extraction system—the first extractor of a tributyl phosphate process for irradiated uranium. Partition coefficients for the main components are presented, and their use in the calculation of extractor performance is demonstrated. Typical results of calculations are illustrated, and the choice of operating conditions, as determined by the behavior of individual components, is discussed. (auth)

2845

SEPARATION OF Th^{234} FROM URANYL NITRATE. L. Kosta. "J. Stefan" Inst. Repts. (Ljubljana) 3, 157-61(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1958, Abstract No. 7703.)

A description is given of two methods for the separation of Th^{234} from uranyl nitrate. One method is based on extraction with mesityl oxide (isopropylidene acetone) and the other on precipitation on bismuth hypophosphate. (J.S.R.)

2846

THE ROLE OF MICRO- AND ULTRAMICROCHEMISTRY IN THE ISOLATION OF THE FIRST TRANSURANIUM ELEMENT: PLUTONIUM. Michael Cefola (Fordham Univ., New York). Microchem. J. 2, 205-17 (1958) Nov.

The role of micro- and ultramicrochemistry in the isolation of the first transuranium element, plutonium, is given. Micropipettes are described. (T.B.A.)

CONTROLLED THERMONUCLEAR PROCESSES

2847 NYO-7905

Princeton Univ., N. J. Project Matterhorn.
PLASMA OSCILLATIONS WITH DIFFUSION IN VELOCITY SPACE. A. Lenard and Ira B. Bernstein. July 22, 1958. 14p. Contract AT(30-1)-1238. (PM-S-35). $0.50(OTS).

A model of plasma oscillations in the presence of small-angle collisions is presented which admits of exact analytic solution. Certain features of the true collision terms are preserved. Namely, the effect of collisions is represented by a diffusion in velocity space, which makes the distribution function tend to the Maxwell distribution, and which conserves the number of particles. In the limit of infrequent collisions the results of Landau are recovered. (auth)

2848 UCRL-4558

California. Univ., [Livermore]. Radiation Lab.
ARC RESEARCH. NOTE ON TABLE TOP INJECTION: HIGH ENERGY INJECTION INSIDE THE MIRRORS. J. R. Hiskes. Aug. 26, 1955. Decl. Nov. 25, 1958. 14p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40 (mf OTS).

High-energy injection into Table Top is discussed for the case in which the ion sources are to be located inside the mirrors in the mirror region. Two typical ion source geometries are considered. Maximum time intervals available for injection are on the order of 7 to 25 μsec. To the extent the assumptions are valid, significant increases in injection time and/or in B = 9 NKT/H_2 can be accomplished by further reduction in the axial length of the ion source, and/or increases in the radial dimension of the solenoid bore. The usefulness of these variations will be set by the emission properties of the ion source. (A.C.)

2849 UCRL-4573

California. Univ., Livermore. Radiation Lab.
ARC RESEARCH: SOURCE DEVELOPMENT PROGRAM. W. A. S. Lamb. Sept. 30, 1955. Decl. Nov. 25, 1958. 3p. $1.80(ph OTS); $1.80(mf OTS).

The current concept of the experimental program on source development for mirror machines is described. (J.R.D.)

2850 UCRL-4580

California. Univ., Livermore. Radiation Lab.
LIQUID-SODIUM INSTABILITY EXPERIMENT. PART II. Stirling A. Colgate. Sept. 30, 1955. Decl. Nov. 25, 1958. 11p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A magnetohydrodynamic model of plasma-magnetic field instabilities, using liquid sodium, has been observed. The growth of flutes in the mirror geometry was observed for the case of $\beta = [NKT/(H^2/8\pi)] = 1$. (auth)

2851 UCRL-4766

California. Univ., Livermore. Radiation Lab.
ENERGY TRANSFER BETWEEN MODIFIED MAXWELL DISTRIBUTIONS. Howard D. Greyber. Sept. 20, 1956. Decl. Nov. 25, 1958. 17p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A convenient modified form of Maxwell distribution is chosen. The modified expressions for the energy transfer from the ions to the electrons in a plasma and the bremsstrahlung from the electrons are calculated. Using the expressions some possible steady-state conditions for the ion and electron gases are derived and compared with those for the usual Maxwell distributions. (auth)

2852 UCRL-4881

California. Univ., Livermore. Radiation Lab.
RESULTS OF BEAM INFLECTION TESTS. William I.

Linlor. Apr. 1, 1957. Decl. Nov. 25, 1958. 32p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

An experimental study was made regarding the passage of a beam of 100-kv ions (H^+ and H_2^+) across a magnetic field by means of a crossed electric field. No difficulties were encountered for currents up to about 10 milliamperes; this value was limited by the current density in the beam and available aperture. The MTA 1-ampere, 100-kv accelerator was used. The pressure in the crossed-field chamber was about 10^{-5} mm Hg. The angular divergence of a 1-milliampere beam from the accelerator was found to be less than 10^{-2} radian. (auth)

2853 UCRL-4905

California. Univ., Livermore. Radiation Lab.
PREFERENTIAL PUMPING AND ITS APPLICATION TO THE P^4 EXPERIMENT. Laurence S. Hall and Andrew L. Gardner. June 14, 1957. Decl. Nov. 25, 1958. 41p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

An analysis is made of the preferential removal of neutral gas from an incompletely ionized plasma in which the ionized particles are allowed to drift along magnetic field lines through a differentially pumped channel, especially as this procedure relates to the P^4 experiment. Included is an analysis of regenerative (pressure-dependent) and non-regenerative losses of plasma by radial diffusion and considerations relating to the ultimate disposal of overflow plasma. Tables illustrating selected conditions are appended. (auth)

2854 UCRL-5044

California. Univ., Livermore. Radiation Lab.
SUMMARY OF UCRL PYROTRON (MIRROR MACHINE) PROGRAM. R. F. Post. June 27, 1958. 40p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The modus operandi of the mirror machine is to create, heat, and control a high-temperature plasma by means of externally generated magnetic fields. Some of the theory of operation of the mirror machine is presented, and the experimental work which has been carried out to date is summarized. (W.D.M.)

2855

ON SOME WORK OF INSTITUTE OF ATOMIC ENERGY IN THE FIELD OF CONTROLLED THERMONUCLEAR REACTIONS. I. V. Kurchatov. Atomnaya Energ. 5, 105-10(1958). (In Russian)

A review is given of the work performed by the Institute of Atomic Energy, U.S.S.R., in the field of controlled thermonuclear reactions. (R.V.J.)

2856

CORRELATIONS IN A PLASMA IN EQUILIBRIUM. J. Yvon (C. E. N., Saclay, France). J. phys. radium 19, 733-8(1958) Oct. (In French)

This paper treats of a fully ionized plasma in thermodynamic equilibrium. An attempt is made at reviewing the calculation of spatial correlations in such a plasma. The equations of recurrence and the principle of superposition are used. The linear approximation is first treated. The next higher approximation is studied in the case of a neutral homogeneous and isotropic plasma. (auth)

CRITICALITY STUDIES

2857 CF-58-8-3

Oak Ridge National Lab., Tenn.
CRITICAL EXPERIMENTS WITH 2.09% U^{235}-ENRICHED URANIUM METAL PLATES IN WATER. J. K. Fox, J. T. Mihalczo, and L. W. Gilley. Aug. 3, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Experiments were performed with 2.09% U^{235}-enriched uranium metal plates in a light-water-moderated and -reflected assembly. Each plate was 30 in. long, $3\frac{1}{8}$ in. wide, and $\frac{1}{4}$ in. thick and contained 7.09 kg of uranium. In the first assemblies the plates were arranged in rows with edges adjacent, and the spacing between rows was varied from $\frac{5}{8}$ to $1\frac{1}{8}$ in. The optimum spacing was about $\frac{7}{8}$ in. With the spacing between rows maintained at $\frac{7}{8}$ in., the spacing between the edges of the plates was varied from 0 to $\frac{5}{8}$ in. The optimum spacing between edges was $\frac{5}{16}$ in. The minimum critical mass in these assemblies was 6.74 kg of U^{235}. (auth)

2858 CF-58-8-5

Oak Ridge National Lab., Tenn.
CRITICAL PARAMETERS FOR POISONED ANNULAR CYLINDERS CONTAINING AQUEOUS SOLUTIONS OF U^{235}. J. K. Fox and L. W. Gilley. Aug. 1, 1958. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Experiments were performed to determine the critical parameters of aqueous solutions of 93.2% U^{235}-enriched uranyl fluoride contained in cylindrical annuli formed by various combinations of aluminum cylinders varying in diameter from 2 to 30 in. In all of the experiments the inside cylinder was lined with a 20-mil-thick cadmium sheet and filled with water to a height of 48 in., and in some experiments a water reflector was used on the sides and bottom of the outside cylinder. The data indicate that for the solution having an $H:U^{235}$ atomic ratio of 50.4 the critical infinitely high reflected annulus would have a minimum thickness between 2.5 and 3 in., while the unreflected annulus would have a thickness between 3.75 and 4.5 in. The corresponding thicknesses for the solution having an $H:U^{235}$ atomic ratio of 309 would be between 3.5 and 4 in. for the reflected annulus and between 4.5 and 5.5 in. for the unreflected annulus. (auth)

2859 CF-58-9-40

Oak Ridge National Lab., Tenn.
CRITICAL EXPERIMENTS WITH ARRAYS OF ORR AND BSR FUEL ELEMENTS. J. K. Fox and L. W. Gilley. Oct. 2, 1958. 6p. Contract [W-7405-eng-26]. $1.80 (ph OTS); $1.80(mf OTS).

Critical experiments were performed with ORR and BSR fuel elements to determine safe arrays in which the elements could be handled and stored. The data indicate that the optimum spacing for criticality of 168-g ORR elements in water is 0.2 in. between locating bosses and that an infinite array of vertically placed elements one element high would probably be subcritical with a $1\frac{1}{2}$-in. spacing between locating bosses. For uniform arrays of adjacent elements in water, variation in the fuel loading per element between 140 and 200 g made very little difference in the critical mass. When 132 elements with an average loading of 160 g per element were closely packed in water in an 11 by 12 element array in which the rows were separated with 20-mil-thick cadmium sheets, no appreciable source neutron multiplication was observed; nor was there any appreciable multiplication when both the cadmium sheets and the water moderator were removed and the array was surrounded with a 12-in.-thick paraffin reflector. A two-row slab-shaped array with 24 200-g center elements and 14 168-g ele-

ments on each end, all spaced 0.2 in. between locating bosses, was subcritical, and it appears that two infinitely long rows of 168-g elements would be subcritical. (auth)

2860

PROMPT NEUTRON PERIODS OF A CRITICAL ASSEMBLY MEASURED WITH A PULSED SOURCE. P. J. Bendt, H. J. Karr, and F. R. Scott (Univ. of California, Los Alamos, N. Mex.). Nuclear Sci. and Eng. 4, 703-8(1958) Dec.

The prompt neutron period of a bare sphere of U^{235} has been measured at two reactivities between delayed and prompt critical. The x-ray burst from a betatron was used to establish the initial neutron population in the critical assembly, and the neutron intensity was observed by photographing oscilloscope traces of pulses from a spiral fission chamber. The values obtained for α, the reciprocal of the prompt neutron period, are $-0.52 \pm 0.03 \times 10^6$ sec^{-1} at 54 cents reactivity, and $-0.26 \pm 0.03 \times 10^6$ sec^{-1} at 76 cents. (auth)

2861

THE ROLE OF CRITICAL FACILITIES. 1. CRITICAL FACILITIES FOR REACTOR DESIGN. W. C. Redman (Argonne National Lab., Lemont, Ill.). 2. CRITICAL FACILITIES FOR BASIC PHYSICS. H. C. Paxton (Los Alamos Scientific Lab., N. Mex.). 3. CRITICAL FACILITIES TOMORROW. Nucleonics 16, No. 12, 40-3 (1958) Dec.

Information is presented on the importance of critical facilities for reactor design. A typical experimental program which includes exponential, critical, and zero-power experiments is reviewed. (J.H.M.)

GEOLOGY AND MINERALOGY

2862 NYO-7909

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.

AN INVESTIGATION OF THE MINERALOGY AND PETROGRAPHY OF URANIUM-BEARING SHALES. ANALYSES OF SHALE SAMPLES. Thomas F. Bates, Erwin O. Strahl, and Robert L. O'Neil. Aug. 25, 1958. 94p. Contract AT(30-1)-1202. $2.25(OTS).

The data include the analyses of 1,135 shale samples taken from 29 drill cores of 9 formations. The geographic location and geologic age of each shale formation are described, and the source of each core is given. A description of the analytical methods employed is given, and references to more complete descriptions are given. (auth)

2863 RME-3156

Massachusetts Inst. of Tech., Cambridge.

A LABORATORY INVESTIGATION OF INDUCED POLARIZATION. Interim Report for 1957-58. Theodore R. Madden and Donald J. Marshall. Aug. 26, 1958. 78p. Contract AT(05-1)-718. $2.25(OTS).

Various experimental methods used in the induced polarization study of rock samples are discussed. These methods include electrical measurements and mineralogical analyses for clays and sulfides. A measurement system has been developed which can measure polarization effects of less than 1%. Practical methods for carrying out the Fourier analysis have been worked out, and frequency information at 10, 1, and 0.1 cycles per second has been derived from the transient measurements. These results are listed in detail for approximately 200 rock samples from several interesting geologic areas. (auth)

2864 . TEI-622

Geological Survey, Washington, D. C.

THE CRYSTAL CHEMISTRY AND MINERALOGY OF VANADIUM. Howard T. Evans, Jr. June 1956. 42p. $7.80(ph OTS); $3.30(mf OTS).

Many recent crystal structure investigations on vanadium oxides and compounds are reviewed in terms of the over-all chemistry and mineralogy of the element. The structure studies are compared with the oxidation potential-pH phase diagram which is constructed from the best available thermodynamic data for the element. From these correlative studies, an alteration sequence is derived for the weathering process of the vanadium ores of the Colorado Plateau. Accordingly, montroseite [VO(OH)] is treated as the primary vanadium mineral. During weathering, montroseite is converted to various insoluble tetravalent and quinquevalent oxide minerals, including paramontroseite and "corvusite." Final oxidation of "corvusite" yields soluble polyvanadate complexes from which crystallize pascoite, hummerite, hewettite, and other quinquevalent vanadate minerals. Under more alkaline environments, duttonite [$VO(OH)_2$] is formed, from which may be derived simplotite, melanovanadite, and rossite. If uranium is present these are converted to rauvite, tyuyamunite, and carnotite. Generally speaking, in its lower valence states vanadium is similar to manganese in behavior, but in the higher states of oxidation it resembles phosphorus (in strongly alkaline media) and molybdenum and tungsten (in acid media). (auth)

2865

RADIOGEOPHYSICS AND THE AGE OF THE EARTH. A. Hee. Age nucléaire No. 7, 27-37(1957) Nov.-Dec. (In French)

The development of radiogeophysics is briefly discussed, and its fundamentals are indicated. The different cases of utilization of radioactive constants for absolute age determinations are discussed. The conditions for the applications of these methods are described. A special discussion is presented of the lead isotopic method of age determinations. The principal works published on determination of the age of the earth are considered briefly. (J.S.R.)

2866

VARIATION OF THE g FACTOR OF YTTRIUM GARNET IN WHICH THE Cr^{3+} IONS HAVE BEEN SUBSTITUTED FOR THE Fe^{3+} IONS. Roger Vautier and Andre-Jean Berteaud. Compt. rend. 247, 1322-4(1958) Oct. 27. (In French)

In the band of 3 cm, the value of g, extrapolated to a zero sample diameter, increases with the chromium content, but in a non-uniform fashion. (tr-auth)

2867

USING NUCLEAR METHODS IN OIL WELL LOGGING. Richard L. Caldwell (Magnolia Petroleum Co., Dallas). Nucleonics 16, No. 12, 58-65(1958) Dec.

Recent improvements on methods of calibration, theoretical treatments in simulated geometeries, measurements in sample wells, and field work are discussed. Nuclear logs are the only ones that work under almost any borehole conditions: in dry, open holes; in open holes filled with mud, salt water, oil, or gas; in cased holes dry or filled with fluid. Information is included on the following types: natural-gamma-ray

logs, scattered-gamma-ray or gamma-gamma logs, neutron-neutron logs, and neutron-gamma logs. (J.H.M.)

2860
GEOLOGY OF MAJUBA HILL, PERSHING COUNTY, NEVADA. Albert F. Trites, Jr. and Ralph H. Thurston. U. S. Geol. Survey Bull. 1046-I. 1958. 24p. and 5 illus. Available from U. S. Government Printing Office, Washington.

Majuba Hill is a complex plug of rhyolitic rocks of Tertiary (?) age in the central part of the Antelope Range, Pershing County, Nev. The plug intrudes sedimentary rocks of Triassic(?) age, which consist chiefly of argillite with smaller amounts of quartzite and impure limestone. It is about 5,000 feet in diameter and has apophyses that extend beyond its margin. The rhyolitic rocks are of three varieties that are here called earlier rhyolite, rhyolite porphyry, and later rhyolite. Five main varieties of intrusive breccia occur in dikes and irregular masses cutting the older rhyolitic rocks. The rhyolitic rocks of the plug and the intruded sedimentary rocks have been silicified, sericitized, and tourmalinized. Three principal preore faults are exposed in the Majuba Hill mine. The largest of these, the Majuba fault, strikes N. 30° W., dips 54°–84° SW., and has a displacement of about 155 ft. Copper and tin are the principal ore metals at Majuba Hill. From 1916 to 1949 slightly more than 27,000 tons of copper ore was produced from the Majuba Hill mine. About 350 tons of tin ore also has been shipped from this mine and small quantities of lead-silver and arsenic-silver ore have been produced from properties nearby. Uranium is locally associated with the copper and tin deposits in the Majuba Hill mine but has not been mined. (auth)

2869
SELECTED ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY AND OCCURRENCE OF URANIUM-BEARING MARINE BLACK SHALES IN THE UNITED STATES. Carolyn E. Fix. U. S. Geol. Survey Bull. 1059-F. 1958. 66p. and 1 illus. Available from U. S. Government Printing Office, Washington for $0.25.

This bibliography consists of 81 annotated references concerned with the geology and occurence of uranium in marine black shales. The annotations, arranged alphabetically by author, present information on geology, geographic distribution, environment of deposition, mode of occurrence, and analytical data. A map shows the distribution and uranium content of uraniferous shales in the United States including Alaska. The data in the annotations are indexed according to author, geographic area, stratigraphic units, and subject. (auth)

2870
LEAD-ALPHA AGES OF THE MESOZOIC BATHOLITHS OF WESTERN NORTH AMERICA. Esper S. Larsen, Jr., David Gottfried, Howard W. Jaffe, and Claude I. Waring. U. S. Geol. Survey Bull. 1070-B. 32p. Available from U. S. Government Printing Office, Washington for $0.15.

The ages of some of the rocks from the four great groups of batholiths of western North America—Baja and Southern California, Sierra Nevada, Idaho, and Coast Range—have been determined by the ratio of lead content to alpha activity of the accessory minerals zircon, monazite, thorite, and xenotime. A suite of 10 intrusive rocks from Baja California, Guerrero, and Oaxaca, in Mexico has a mean age of 101 ± 5 million years; the batholith of Baja California has been determined as being of early Late Cretaceous age on the basis of stratigraphic and paleontologic evidence. Twenty-five age determinations on rocks from the batholith of southern California, ranging from tonalite to granite, give a mean age of 110 ± 13 million years; geologic evidence indicates that this batholith is early Late Cretaceous in age. Age determinations on 15 rocks from the Sierra Nevada batholith give a mean age of 102 ± 11 million years; on geologic evidence the Sierra Nevada batholith is considered to be Late Jurassic. Age determinations on 16 rocks from the Idaho batholith average 108 ± 12 million years; this batholith has been geologically dated as Cretaceous in age. Age determinations on 16 rocks of the Coast Range batholith including the batholiths of Washington, British Columbia, and Alaska, average 105 ± 13 million years; these batholiths are believed to be equivalent in age to the Sierra Nevada batholith. The ages of the four groups of rocks are the same—about 106 ± 12 million years; they are all believed to be early Late Cretaceous. The time required for emplacement of the entire batholithic system is believed to be only a few million years. The batholiths make a discontinuous echelon group of intrusive bodies about 4,000 miles long and possibly much longer. (auth)

2871
PHOTOGEOLOGIC MAP OF THE IRIS SE AND DOYLEVILLE SW QUADRANGLES, SAGUACHE COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-277. Kathleen McQueen. Washington, U. S. Geological Survey, 1958. $0.50.

2872
PRELIMINARY GEOLOGIC MAP OF THE HOUSE ROCK SPRING NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 188. John D. Wells. Washington, U. S. Geological Survey, 1958. $0.50.

2873
RADIOAKTIVNYYE METODY ISSLEDOVANIYA NEFTYANYKH I GAZOVYKH SKVAZHIN. (Radioactive Methods for Exploring Oil and Gas Wells.) Oleg Aleksandrovich Barsukev, Nina Mikhaylevna, et al. Moscow, Gostoptekhizdat, 1958. 314p.

The physical principles of radiometry of gas and oil wells are stressed. The operation of radiometric instruments and measuring procedures are described, and the interpretation of the data obtained is discussed. (J.S.R.)

2874
SPRAVOCHNIK PO RADIOMETRII DLYA GEOFIZIKOV I GEOLOGOV. (Handbook on Radiometry for Geophysicists and Geologists.) V. I. Baranov, N. G. Morozova, A. S. Serdyukova, P. I. Chalov, and V. L. Shashkin, compilers. Moscow, Gosgeoltekhizdat, 1957. 198p.

The field of radioprospecting is surveyed. Naturally occurring radioactive transmutation is discussed, and the radiation given off during transmutation is described. The equipment and methods used in radioprospecting are reviewed. The radioactivity in the earth's crust is discussed, and the determination of geological age by radiometric methods is considered. Brief instructions are presented on the handling of radioactive materials. 181 references. (J.S.R.)

HEALTH AND SAFETY

2875 AERE-C/R-2622
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SMALL SCALE REMOTE HANDLING OF CURIE LEVELS OF BETA, GAMMA ACTIVE SOLUTIONS. J. H. Moss, G. P. Kitt, and P. E. Brown. Oct. 1958. 33p. $0.63(BIS).

A description is given of simple and flexible chemical equipment and techniques used in the small-scale (0.1 to 400 ml) remote handling of up to 10 curies of fission products. The advantages, limitations, and possible extensions of the methods used are discussed. (auth)

2876 ANL-5920

Argonne National Lab., Lemont, Ill.

ON THE STRATOSPHERIC Sr^{90} FALLOUT. P. K. Kuroda. Oct. 1958. 40p. Contract W-31-109-eng-38. $1.25(OTS).

The fraction (α_D) of the delayed fall-out in the total fall-out (F) of a fission product A is given by $\alpha_D \cong [y_B/y_A - T \cdot \exp\{(\lambda_B - \lambda_A)t\}] \cdot (y_B/y_A - S_0^i)^{-1}$, where y_B/y_A is the ratio of a pair of chemically similar fission products B and A freshly produced by a nuclear explosion at t = 0, λ_A and λ_B are the decay constants of A and B, S_0^i is the B/A ratio in the stratosphere at t = 0 (just prior to the nuclear explosion), T is the B/A ratio in rain water or in the troposphere at time t. The fraction (α_S) of the stratospheric fall-out in the total fall-out (F) is usually very nearly the same as the fraction (α_D) of the delayed fall-out. The ratios of Ba^{140}/Sr^{90}, Sr^{89}/Sr^{90}, and Ba^{140}/Sr^{89} in a series of rainfalls which occurred at Lemont, Illinois, during the period between October 15, 1957, and June 1, 1958, were measured, and the rates of stratospheric and tropospheric fall-out were calculated. The average rate of stratospheric fall-out was 2.4 mc/km^2/year and that of tropospheric Sr^{90} fall-out 0.16 mc/km^2/year, i.e., 94% of the total Sr^{90} fall-out was stratospheric. The rate of Sr^{90} fall-out decreased in the fall and increased in the spring. Fundamental principles of the method described are directly applicable to the problem of the detection of nuclear test explosion. (auth)

2877 CML-M124-5

Chicago. Univ. Chicago Midway Labs.

HIGH-ALTITUDE SAMPLING TECHNIQUES. Progress Report No. 5 [for] September 1958. 13p. Contract AT(11-1)-508. (CML-SR-M124-5). $3.30(ph OTS); $2.40(mf OTS).

Previous reports have covered the design, operation, and testing of the air collection unit and the operational balloon flight. General balloon flight procedure and the performance of the second and third flights are described. Radiation analysis has not yet been received. (A.C.)

2878 IGO-R/R-8

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

OBSERVATIONS ON THE METABOLISM OF SOLUBLE URANIUM IN HUMANS. A. Butterworth and A. S. McLean. Dec. 9, 1955. 11p.

Autopsy specimens from an employee who died as a result of coronary thrombosis were analyzed for uranium. The employee has been engaged in the production of uranium hexafluoride until the day prior to death. The results of continuous air monitoring surveys and uranium in urine analyses are recorded, and their relation to the uranium found in the autopsy specimens of kidneys and lungs is discussed. The validity of certain of the metabolic data and values quoted in the recommendations of the International Commission on Radiological Protection is questioned. (auth)

2879 TOI-58-26

Technical Operations, Inc., Burlington, Mass.

RADIOLOGICAL DEFENSE PLANNING GUIDE. PART I. PLANNING ANALYSIS AND DATA. PART II. MODEL RADIOLOGICAL DEFENSE PLANS. Franklin C. Brooks, Emerson D. Callahan, Eric T. Clarke, John F. Batter, and Arthur L. Kaplan. July 31, 1958. 346p. Prepared under Subcontract with the Commonwealth of Massachusetts, Federal Civil Defense Administration, Contract No. CD-SP-57-59.

Model radiological defense plans are presented for civil defense organization at levels from local community to state. These plans are designed to minimize casualties from radiological fallout in the event of an enemy nuclear attack. They are suitable for implementation by January 1959. The detailed data and analysis leading to the model plans are also presented. (auth)

2880 UWFL-54

Washington. Univ., Seattle. Applied Fisheries Lab.

RADIONUCLIDES IN PLANKTON NEAR THE MARSHALL ISLANDS, 1956. Frank G. Lowman. Feb. 14, 1958. 34p. Contract AT(45-1)540. $1.00(OTS).

Radiochemical separations were made on plankton samples collected in and west of the Eniwetok Proving Ground in September 1956. Ion exchange resin column and precipitation techniques were used. Fission products, mainly Zr^{95}–Nb^{95} and Ce^{144}–Pr^{144}, contributed an average of 29% of the total radioactivity. The remaining 71% of the activity was contributed by the non-fission radioisotopes Zn^{65}, $Co^{57,58,60}$, Fe^{55}, and Mn^{54}. Radioactive zinc, cobalt, and iron accounted for averages of 24, 26, and 21%, respectively, of the total radioactivity. Mn^{54} was present in trace amounts. Variations in ratio of occurrence for the different non-fission products with change in geographical location was observed. Relatively high levels of Zn^{65} were centered in the area near Bikini and Eniwetok Atolls. The area of high levels of radioactive cobalt and iron in comparison to Zn^{65} was located approximately 480 miles west and slightly north of Eniwetok Atoll. (auth)

2881 UWFL-55

Washington. Univ., Seattle. Applied Fisheries Lab.

RADIOBIOLOGICAL STUDIES OF THE FISH COLLECTED AT RONGELAP AND AILINGINAE ATOLLS, JULY 1957. Arthur D. Welander. Mar. 5, 1958. 33p. Contract AT(45-1)540. $1.00(OTS).

Radiobiological analysis of the reef fishes of Rongelap and Ailinginae Atolls indicated that a recontamination of the area occurred in 1956. Gross levels of beta activity in muscle tissue ranged from 0.016 to 0.038 μc/kg wet weight. The levels of radioactivity in bone and muscle tissues of fish collected during 1957 were about the same as the levels for similar tissues collected in 1955. Gamma spectra analysis and ion-exchange methods revealed the presence of Zn^{65}, Co^{57}, Co^{58}, Co^{60}, Mn^{54}, and Fe^{55}. Radiostrontium was found only in small amounts (about 0.0014 μc/kg wet weight) in the bone of fish from Kabelle Island, Rongelap Atoll. Approximately 40 per cent of the total radioactivity in the reef fishes was due to Zn^{65}, 28 per cent to cobalt, 26 per cent to Fe^{55}, and 6 per cent to other radionuclides. (auth)

2882 UWFL-56

Washington. Univ., Seattle. Applied Fisheries Lab.

THE OCCURRENCE OF ANTIMONY-125, EUROPIUM-155, IRON-55, AND OTHER RADIONUCLIDES IN RONGELAP ATOLL SOIL. Ralph F. Palumbo and Frank G. Lowman. Apr. 7, 1958. 27p. Contract AT(45-1)540. $1.00(OTS).

Soil samples from Rongelap Atoll were analyzed for radionuclide content. Using ion-exchange methods, a detailed study was made of a soil sample collected in a bird nesting area at Kabelle Island in July 1957. Two radioisotopes, antimony-125 and europium-155, not previously reported in samples from the Pacific Proving Ground were found and their identity was verified by radiochemical precipitation techniques. The radionuclides contributing most of the radioactivity were Ce^{144}-Pr^{144} and Fe^{55}, a non-fission product. Other radionuclides present in much smaller amounts included Ru^{106}–Rh^{106}, Sr^{90}–Y^{90}, Cs^{137}, Mn^{54}, Co^{60}, Zr^{95}–Nb^{95}, Co^{57}. (auth)

2883 WADC-TR-56-436

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

THE RETENTION OF FISSION PRODUCTS BY SOILS UNDERLYING THE NUCLEAR ENGINEERING TEST FACILITY AT WADC. Period covered: September 1955 to January 1957. Bruce Raby and George John. Jan. 1957. 31p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: ISOTOPIC TRACER APPLICATIONS TO AIRCRAFT MATERIALS. (AD-151081).

A study was made of the retention of fission products by soils underlying the site for the Nuclear Engineering Test Facility. The purpose of the study was to provide some data which would be of value in planning for the contingency of a reactor run-away and for possible seepage of contaminated water during normal operation. Experiments were conducted to determine total capacity of the soils, equilibrium sorption of ions by the soil in a static system, and elution of ions from the soil by water. These experiments were of an exploratory nature, and although not complete, do give an indication of the soils' ability to retain various fission products. However, on the basis of the few experiments performed, it is possible to provide only qualitative information and to indicate the direction and extent of future studies. (auth)

2884 AEC-tr-3500

RADIOACTIVE CARBON IN THE ATMOSPHERE PRODUCED BY ATOMIC EXPLOSIONS. K. O. Münnich and J. C. Vogel. Translated from Naturwissenschaften 45, 327-9(1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 16146.

2885

THE ACCUMULATION OF RADIOELEMENTS IN CERTAIN GROUPS OF WATER ORGANISMS. D. I. Il'in, Yu. I. Moskalev, and A. I. Petrova. Atomnaya Energ. 5, 171-4(1958). (In Russian)

Studies of radioactive element accumulations in live organisms in a water basin with 2 to 4×10^{-8} c/l specific activity indicated selective uptake of P^{32}, Sr^{89}, Sr^{90}, Cs^{137}, and Na^{24} in plankton, benthon, and fish. The concentration of P^{32}, is higher by an order of three to four in fish, plankton, and deep-sea organisms than in water, and Sr^{89}, Sr^{90}, and Cs^{137} by an order of two to three. The accumulations of β-active elements found in fish organs were principally in the muscles (44 to 59%) and in the skeleton (16 to 24%). The accumulation of β-active elements in skeleton, gills, fins, and scales is 3 to 5 times higher than in the soft tissues. (tr-auth)

2886

PROTECTION AGAINST FALLOUT RADIOACTIVITY. E. E. Massey. Can. Textile J. 75, No. 10, 59-61(1958).

Practical textile materials cannot give significant protection from gamma radiation but can prevent fallout particles from contaminating the skin. Heat protection can be provided by fire-resistant light-colored textiles. (auth)

2887

QUANTITATIVE RELATIONSHIP BETWEEN THE DOSE OF IONIZING RADIATION AND THEIR POSSIBLE HARMFUL EFFECT ON HEREDITY IN MAN. N. P. Dubinin. Doklady Akad. Nauk S.S.S.R. 122, 713-15(1958) Oct. 1. (In Russian)

Analysis is made of the genetic effects of radiation on man based on the new data produced by G. G. Tinyakov (Doklady Akad. Nauk S.S.R. 122, 598(1958)) which showed that the frequency of chromosome reorganization in ape sperm cells exposed to 400 r is considerably higher than that obtained in experiments with mice (on the 11th day after irradiation the number of nuclei damaged by chromosome reorganization in apes was 28.66% and in mice 11.12%). (R.V.J.)

2888

A NEW RADIATION-SECURE VAULT FOR THE STORAGE OF RADIOACTIVE SUBSTANCES. K. Knopp and A. Rummel (Univ.-Frauenklinik Würzburg, Ger.). Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 483-5(1958) Oct. (In German)

A new vault for the storage of radioactive substances was constructed. It has advantages compared with previous ones in offering not only good protection against radiation and theft, but also in shielding the hands of the therapist. This was achieved by means of a mechanism placed at some distance from the source and which causes opening or closing of the tubular container by means of pressure or traction. (auth)

2889

THE ATMOSPHERIC DIFFUSION OF GASES DISCHARGED FROM THE CHIMNEY OF THE HARWELL REACTOR BEPO. N. G. Stewart, H. J. Gale, and R. N. Crooks (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Air Pollution 1, 87-102(1958) Oct.

The 61 m chimney of the BEPO reactor discharges warm air containing a small amount of radioactive argon. This gas has been used as a tracer to study the diffusion of the plume in the atmosphere downwind of the chimney. Surveys have been carried out at ground level up to a distance of 10,000 m and, with instruments suspended from a balloon, up to a height of 300 m at a maximum range of 1000 m. The results have been correlated with the gradient of potential temperature in the atmosphere near ground level. The effective height of the plume is found to depend on the wind velocity u and on the temperature gradient, having a mean value of 125 m under adiabatic conditions when u = 7 m/sec. The diffusion of the plume over the range studied occurs in three distinct phases. Near the chimney, the rate of vertical diffusion is about twice that in the horizontal direction as a result of the discharge conditions. As the plume diffuses towards ground level it enters a region dominated by building turbulence and the rate of diffusion in both directions is greatly increased. Finally, as it travels beyond the built-up area, the rate of diffusion reverts to that characteristic of diffusion over open country. Sutton's diffusion equations cannot be simply applied to this complex type of problem, but they provide a useful model for classifying the data, and

effective values of the virtual diffusion constants C_y and C_z are derived for each stage of the diffusion process. Under adiabatic and stable conditions, peak ground-level concentrations between 1.3×10^{-6} and 3.5×10^{-6} units/m^3 were observed at approximately 1000 m downwind with wind velocities in the range 6 to 12 m/sec and a chimney emission rate of 1 unit/sec. Under statically stable conditions no detectable concentrations were found on the ground within 10,000 m of the chimney. (auth)

2890

A STUDY OF THE RADON CONTENT OF GROUND LEVEL AIR AT HARWELL. H. J. Gale and L. H. J. Peaple (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Air Pollution 1, 103-9(1958) Oct.

The radioactive gas radon enters the earth's atmosphere as a natural emanation from many rocks and soils. During a period of a year continuous measurements were made of the radon in the atmosphere near ground level at Harwell by drawing air through a moving filter strip and measuring the radioactive disintegration rate of the radon decay products thus collected. The observed concentrations appear to be closely connected with atmospheric stability, being high when the gradient of potential temperature is positive. A marked diurnal variation is observed closely following a similar variation in the gradient of potential temperature. The average concentration over the year was 64 pc/m^3 and the maximum recorded 386 pc/m^3. (auth)

2891

THE PHYSICAL CONTROL OF RADIOACTIVE CONTAMINATION. A. Malvicini and C. Polvani (Univ. of Milan). Minerva nucleare 2, 261-303(1958) Oct. (In Italian)

A survey is presented of the physical control of radioactive contamination. The physical and biological considerations necessary for the correct evaluation of the problem of contamination are briefly discussed. These considerations include the concept of radioactive contamination, use of radiation detection instruments, identification of the type and quality of radiations, and measurement of the quantity of radioactivity. The core of the paper deals with the detection and measurement of contamination in gases, liquids, surfaces, and solids. 56 references. (J.S.R.)

2892

FACTORS AFFECTING THE RELATIVE DEPOSITION OF STRONTIUM AND CALCIUM IN THE RAT. Ray F. Palmer, Roy C. Thompson, and Harry A. Kornberg (General Electric Co., Richland, Wash.). Science 128, 1505-6(1958) Dec. 12.

Varying the calcium, phosphorus, carbonate, and lactate content of the diet was shown to affect the deposition in bone of Sr^{89} to a degree quite different from concurrent effects on Ca^{45} deposition. The influence of these findings on the evaluation of the Sr^{90} fallout hazard is discussed. (auth)

2893

HOW MUCH RADIOACTIVE DUST FALLS ON OUR TERRITORY? Vladimir Drasil and Vladimir Kleinwachter (Biophysics Inst., Brno). Vestnik CSAV 66, No. 3-4, 172-3(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1958, Abstract No. 7717.)

To determine the amount of Sr^{90} falling as a result of the experimental tests on atomic and nuclear bombs, the following method was used. A glass vessel measuring 20 × 20 × 35 cm, on the bottom of which there was a layer of water approximately 0.5 cm thick, was left in the air for a month to capture the dust. The water was evaporated and the precipitate coated on a plate to measure its activity. The decay of the material during the month was computed. Measurements of the activity gave 69 pulses per minute above background. These measurements give the following results: in the city of Brno there fell during 30 days a dust with activity of 5.3 microcurie per square km (measurement of 1957). Subsequent analysis has shown that the dust contains considerable doses of K (14% of the entire activity is caused by the potassium).

INSTRUMENTS

Refer also to abstract 3463.

2894 AECU-3755

Wisconsin. Univ., Madison.

DIFFERENTIAL VOLTAMMETRY USING THE HANGING MERCURY DROP ELECTRODE. Kenneth J. Martin and Irving Shain. [1958]. 12p. Project No. [17]. Contract [AT(11-1)-64]. $3.30(ph OTS); $2.40(mf OTS).

Presented at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, March 1958.

The general techniques of voltammetry with continuously varying potential have been applied to a differential method in which two electrolysis cells are used, each with a hanging mercury drop electrode. Using this method it is possible to determine 10^{-6} M solutions with increased precision, and it is also possible to analyze solutions as dilute as 10^{-5} M without removing oxygen from the electrolysis cells. Mixtures can be analyzed easily by adding individual components of the mixture to the reference cell. (auth)

2895 AERE-G/R-426

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DOSEMETER TO BE USED WITH THE 10 MEV LINEAR ELECTRON ACCELERATOR FOR THE MEDICAL RESEARCH COUNCIL. J. G. Thomason. Nov. 1949. Changed from OFFICIAL USE ONLY Dec. 11, 1958. 32p. (HD-73M).

The dosimeter described is designed to monitor the intensity of gamma radiation delivered by a clinical linear electron accelerator. The dose rate and total (integrated) dose are displayed on meters, and provision is made for the accelerator to be automatically shut off when a prescribed dose has been delivered. A section is devoted to the theory of the circuits, showing how the somewhat stringent demands for accuracy have been met. Setting-up and calibration procedure are outlined, with a view to assisting users of the dosimeter. (auth)

2896 CERN-58-24

European Organization for Nuclear Research, Geneva.

INTERNATIONAL MEETING ON INSTRUMENTS FOR THE EVALUATION OF PHOTOGRAPHS, HELD AT CERN, GENEVA, ON SEPTEMBER 15 AND 16, 1958. SUMMARY OF PROCEEDINGS. Oct. 1, 1958. 56p.

The application of automatic measuring and computing techniques to the evaluation of track-chamber photographs is presented. (W.L.H.)

2897 CREL-769

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSISTORIZED COUNTING SYSTEMS. 3. TIMING UNIT FOR USE IN TIMESORTERS. T. K. Alexander. Sept. 1958. 18p. (AECL-694). $0.50(AECL).

A timing unit consisting of a precise variable delay from 20 microseconds to 2.5 milliseconds and a precise gated oscillator giving pulses at intervals of 2, 4, 8, 12, 16, or 20 microseconds has been developed using the basic transistor trigger circuits described in CREL-767. The stabilities of the delay and timing gates are functions of the temperature stability of delay lines only, and using commercially available delay cable a stability of ± 0.025%/°C has been realized. The unit is self-contained and has been made flexible so that it can be applied to most slow-neutron time-of-flight problems. (auth)

2898 DP-304

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

AN INSTRUMENT FOR INDICATING MERCURY LEVEL INSIDE THICK-WALLED STEEL PIPE. T. Richard Herold. Aug. 1958. 7p. Contract AT(07-2)-1. $0.50 (OTS).

An instrument was developed which uses a radioactive source and a scintillation counter to detect the level of a mercury column inside thick-walled steel pipe. (auth)

2899 HW-56506

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

MULTICOLOR PYROMETRY. B. B. Brenden and H. W. Newkirk. Sept. 1, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A theoretical analysis is presented which discusses the accuracies which would be required for practical application of three-color temperature measurement methods. The analysis was applied to the errors involved in using brightness pyrometers and two-color pyrometers to determine the three-color temperature. The results show that brightness temperature determinations must be accurate to ±0.5°K, whereas two-color temperature determinations must be made to an accuracy of ±5°K in order to be usable in a three-color temperature measurement. It is concluded that three-color temperature measurements are practical and offer the advantage of permitting a variation of emissivity with wavelength and do not require a knowledge of emissivity. (auth)

2900 HW-57266

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PULSE READING METHOD FOR CONDENSER ION CHAMBERS. W. C. Roesch, R. C. McCall, and F. L. Rising. [1957]. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Presented at the Health Physics Society Meeting, held at Berkeley, Calif., June 9-11, 1958.

A new method has been developed for the measurement of low levels of radiation using condenser ionization chambers such as the pencils used in radiation protection work. The method of reading utilizes the magnitude of the current pulse required to recharge the pencils after they have been exposed. Any charging voltage may be used without a change in sensitivity. Using a low charging voltage reduces leakage to a very low level. Full range of pencils charged to 20 volts is about 30 mr. Higher charging voltages can be used to increase this range. Sensitivity of a small fraction of a milliroentgen is available. Readings of 1 ± 0.2 mr or 10 ± 1 mr are possible at 95% confidence with a single pencil. The system has been used at HAPO to measure background on the project, on the Columbia River, and in the environs. Typical values are presented. Other possible applications are accurate personnel monitoring and neutron dose measurement. This system lends itself to automation of records keeping. (auth)

2901 HW-57700

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRTR PROCESS CHANNEL LEAK DETECTION FACILITY. Final Report—Design Test PR-63. R. F. Scheloske. Oct. 28, 1958. 11p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The core of the Plutonium Recycle Test Reactor (PRTR) is filled with water. A leak of any finite size from any of the many possible sources may constitute a serious reactor operational problem. The helium gas filling the annulus or process channel between the process tube and Al shroud tube of the calandria is to act as the leak detection medium for either process tube or shroud tube leaks. A single process channel test facility was constructed for this design test. From results of this test, it is concluded that a leak detection system based on the change of the dew point of the He gas passing through the process channel will give a positive indication of process tube or shroud tube leaks. It may be difficult to pinpoint the leak to a single process channel if the leak occurs above the shroud tube bellows due to the low leakage rate at which water vapor will spread to adjacent process channels. (W.L.H.)

2902 HW-58101

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRESSURE CONTROL OF STATIC-TYPE, GLOVE-OPERATED HOODS. Preliminary Report. C. D. Swanson. Nov. 4, 1958. 66p. Contract W-31-109-Eng-52. $1.75(OTS).

This study was initiated to determine the performance requirements of a ventilation control system suitable for use with static-type glove hoods. Hoods of this type are used to enclose machining operations or other work areas where toxic radioactive materials are to be processed or stored, and where the flow of atmospheric gas through the hood is to be kept at a minimum for economic reasons. (auth)

2903 IDO-14456

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE REMOTE ANALYTICAL FACILITY MODEL "B" PIPETTER. Fred W. Dykes, John P. Morgan, and William G. Rieder. Oct. 20, 1958. 57p. Contract AT(10-1)-205. $1.75(OTS).

The RAF Model B pipetter is a device designed to pipet aliquots of highly radioactive samples. It incorporates features of two previous models and several years of operating experience. Design criteria were accuracy of delivery, reliability of operation, and ease of operation and maintenance. A complete description of the pipetter and its operation and maintenance is presented. (auth)

2904 LA-2265

Los Alamos Scientific Lab., N. Mex.

SHORT BIBLIOGRAPHY ON ORGANIC SCINTILLATORS AND THEIR APPLICATIONS. Ruth M. Hendrickson, comp. Oct. 1958. 26p. Contract W-7405-Eng-36. $1.00(OTS).

A bibliography is presented on organic scintillators and their applications. (W.L.H.)

2905 NP-7024
Detroit. Univ.
THE STUDY OF PROPERTIES OF SINGLE CdS AND ZnS CRYSTALS FOR USE AS DETECTORS IN CRYSTAL COUNTERS. Technical Report No. 4. Period Covered: September 1, 1957 to August 31, 1958. S. J. Czyzak, H. Payne, R. C. Crane, and W. M. Baker. Oct. 1, 1958. 57p. Project No. NR-015-218. Contract Nonr-1511-(01).

Progress is reported on a theoretical and experimental study of the properties of single crystals for use as detectors and crystal counters. The latest procedure for growing single crystals as well as new techniques for powder preparation has resulted in the production of single crystals which are not only larger but of greater purity. Both hexagonal and cubic ZnS crystals were grown. Construction of a new furnace made it possible to reach 1550°C in approximately one hour and made it possible to grow mixed ZnS:CdS crystals with greater ease. Large thin prisms were cut from the relatively pure crystals. New techniques and more sensitive apparatus were employed in measurements of the electrical properties of CdS and ZnS crystals. An approximate method was developed for calculating the electronic charge distribution in the corresponding potential field. (C.H.)

2906 NP-7046
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
NUCLEAR EMULSION PROCESSING AND LOADING WITH METAL VERSENE COMPLEX. (Development at Isoelectric Point). H. G. de Carvalho and A. G. da Silva. Aug. 5, 1958. 7p. (Notas de Física Vol. IV, No. 12).

Versene is shown to be a good complexing agent to help the loading of emulsions at suitable pH's, to be ferro-complex, and also to be a satisfactory developing agent possibly causing minimum distortion. Requirements for a good processing technique are listed. (A.C.)

2907 NYO-4705
New York Operations Office, AEC.
FEASIBILITY REPORT ON A COBALT 60 FLUOROSCOPIC IMAGE INTENSIFIER SYSTEM. H. D. LeVine. Apr. 1956. 23p. $0.75(OTS).

Technically, it will be possible for manufacturers of photosensitive devices to make a 20-inch-diameter photocathode pick-up tube either as an Image Orthicon device or a Videcon. The improvement in light pick-up will permit the radiation level to be decreased from the present 600 mr-minute level. The investigation includes cost and delivery estimates as well as a feasibility study. (W.L.H.)

2908 RDB(W)TN-145
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
FLOW TESTS ON PERIPHERAL-TYPE COMPRESSOR. T. Burgoyne. 1958. Date of MS. June 1954. 17p.

The compressor was tested with air both as a two-stage model with inter-cooling and as a single-stage model. The effect of varying the shape of the annulus and the rotor blades was examined and the pressure rise measured round the compressor. Some sealing gas tests were also carried out for gland sealing purposes. (auth)

2909 SCR-49
Sandia Corp., Albuquerque, N. Mex.
A SYSTEM FOR OSCILLOSCOPE CAMERA-POSITIONING. Paul L. Kerley and Vaughn D. Nogle. Nov. 1958. 9p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40 (mf OTS).

Published without the supplement in Electronic Ind., Aug. 1958.

The positioning system adapts the Polaroid-Land camera and the DuMont camera mount to permit multiple sweep exposures on each print. It consists of a timer, timer selector, motor drive, rack and pinion gear, limit switches, shutter solenoid, and a power supply. The system is an integral part of the equipment. A detailed description is given together with drawings and diagrams. (J.R.D.)

2910 SCTM-330-58(14)
Sandia Corp., Albuquerque, N. Mex.
NUCLEAR BATTERY POWERED TIMERS. R. L. DesJardin. Sept. 19, 1958. 19p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

During the period from May 1957 to July 1958, four nuclear battery powered timers were fabricated and tested from two basic designs in the time ranges of one-second, three-second, and half-hour intervals. The timers were temperature-tested over a range of −65° to +165°F with accuracies over this temperature range from ±10 percent to ±15 percent. Each unit has a volume of 10 cubic inches, and the timer can be initiated either by an explosive squib or a pull-out wire. At the end of the timing interval, the timer has an output of 30,000 ergs. The cost of the program was $24,000. From the results of this development program, it appears quite feasible to build operable nuclear battery powered timers on a production basis. (auth)

2911 SCTM-343-58(14)
Sandia Corp., Albuquerque, N. Mex.
MEASUREMENT OF MICROWAVE PEAK POWER, USING THE 'NOTCH' MEASUREMENT TECHNIQUE. C. E. Morgan. Oct. 10, 1958. 10p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

An accurate method of determining the peak power of a microwave oscillator cavity is described. This is used to aid in the determination of oscillator cavity efficiency and measurement of packaged radar transmitters. The peak power range is from 0.5 to 10.0 kilowatts. (auth)

2912 UCRL-8482
California. Univ., Berkeley. Radiation Lab.
EQUIPMENT AND METHODS FOR AUTOMATIC TRACK ANALYSIS. Walter H. Barkas. Aug. 14, 1958. 31p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

A comprehensive program has been initiated at the University of California Radiation Laboratory to give practical aid to the physicists and technicians carrying out track measurements. Attention has been given to stack alignment, coördinate read-out, grain-density measurement, multiple-scattering measurements, and data recording. (A.C.)

2913 UCRL-8515
California. Univ., Berkeley. Radiation Lab.
TRANSISTORIZED LINEAR PULSE AMPLIFIERS. Stanley C. Baker. Oct. 27, 1958. 28p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The basic investigation of transistor feedback amplifiers has proven mathematically simple and of great

practical value. The behavior of single-stage common-emitter amplifiers is described and provides a building block with which cascaded feedback amplifiers can be analyzed and designed. From the results of this analysis the conditions for minimum drift for cascaded single-stages and cascaded loops have been derived. A transistorized linear amplifier, pulse-height discriminator, scaler, and high-voltage power supply packaged together as a single piece of portable counting gear is under development. The high-gain linear amplifier is the heart of the system and must have good reliability, wide bandwidth, small temperature-drift effects, etc. The amplifier developed has a rise time of 0.5 μsec and current gain of 7,000, and is designed to drive a current-pulse discriminator so that only a few volts swing at the output are needed. (auth)

2914 WCLT-TM-57-93

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

HIGH INTENSITY THERMAL FLUX MEASUREMENTS IN THE UNSTEADY STATE. G. Sonnenschein and R. A. Winn. July 19, 1957. 10p. Project No. 7360.

A flux gage is described which has been shown suitable for the measurement of thermal fluxes up to 75 cal/cm^2-sec. It is anticipated that this gage will be useful in the measurement of thermal fluxes reading as high as 1000 cal-cm^2-sec by proper choice of the material used in its construction. (A.C.)

2915

CHANNEL AMPLIFIER FOR IMPULSES IN THE MILLI-MICROSECOND RANGE. Florin Tinta. Acad. rep. populare Romîne Inst. fiz. atomica şi Inst. fiz. Studii cercetări fiz. 9, 290-3(1958). (In Rumanian)

The schematic and characteristics of a channel amplifier for use with millimicrosecond pulses are given. (J.S.R.)

2916

DETECTION OF NUCLEAR PARTICLES. IONIZATION CHAMBERS AND COUNTERS. Daniel Blanc. Age nucléaire No. 6, 53-9(1957) Sept.-Oct. (In French)

A survey is presented of particle detectors based on ionization in a gas by the particle to be detected and giving an electric signal. The historical development of detectors is briefly discussed. The characteristics and properties of the ionization chamber, proportional counters, Geiger-Mueller counters with organic vapor, counters with halogens, and spark counters, which are still in the development stage, are described. Some industrial applications of radiation detection instruments are considered. (J.S.R.)

2917

A MULTICHANNEL TIME-OF-FLIGHT FAST NEUTRON SPECTROMETER. A. A. Kurashov, A. F. Linev, B. V. Rybakov, and V. A. Sidorov. Atomnaya Energ. 5, 135-40(1958). (In Russian)

A multi-channel time-of-flight fast neutron spectrometer is described, using cyclotron natural beam modulations. The system consists of 256 channels of 2^{16} pulses per channel. (tr-auth)

2918

USE OF TERPHENYL IN RECORDING β PARTICLES. R. V. Semova. Atomnaya Energ. 5, 177-8(1958). (In Russian)

Descriptions are given for a high-efficiency, terphenyl-containing (90 to 95%), β-particle recording scintillator. It is shown that the recording efficiency of the detector depends greatly on the thickness of the terphenyl layer. The γ-ray recording with terphenyl is ~0.04 for Co^{60}. Consequently, the scintillator can be used for recording β particles in the presence of a strong γ-ray background. (R.V.J.)

2919

COMPLETELY AUTOMATIC MECHANIZED MULTI-KILOCURIE COBALT-60 IRRADIATION FACILITY FOR SCIENTIFIC RESEARCH, LARGE-SCALE INDUSTRIAL APPLICATION, AND RADIATION THERAPY. O. F. Joklik (Transcontinental Atomic Co., Lugano, Switzerland). Atompraxis 4, 355-63(1958) Oct. (In German)

The large-scale industrial use of gamma radiation requires highly versatile research facilities with multi-kilocurie Co^{60} radiation sources. Certain constructive examples of completely automatic mechanized gamma-radiation facilities are given, in which the radiation source can either be immersed or the objects under exposure can be radiated in any desired physical form, in charges or continuously, beside the vertical rod-shaped radiation source in one or more parallel radiation cylinders; the radiation can be switched off automatically either after a predetermined time (up to 120 hours) or after a certain dose (up to 10 million r), and radiation conditions can be varied at will from +450° to −160°C at pressures up to 100 kg/cm^2 or in high vacuum. A brief discussion is given of large-scale industrial radiation facilities; in conclusion there is a description of a modern radiation-therapy facility with multikilocurie Co^{60} radiation sources of high specific activity. This study is intended to show some interesting constructive solutions in the field of radiation research facilities and new radiation-therapy facilities with strong gamma sources, and thus to contribute to basic research in the field of applied radiation technology. (auth)

2920

THE 4 Mev LINEAR ACCELERATOR AT NEWCASTLE UPON TYNE. M. J. Day and F. T. Farmer (Royal Victoria Infirmary, Newcastle upon Tyne, Eng.). Brit. J. Radiol. 31, 669-82(1958) Dec.

An account, based on four years operation, is given of the first of the 4-Mev linear accelerators (Mullard) installed for medical use. Its isocentric mounting in conjunction with the specially designed single-pillar couch makes for rapid and accurate setting up of patients, and it may be used for fixed or moving field therapy. The x-ray output is up to 250 r/minute at 100 cm F.S.D. and 400 pps; the H.V.L. 15.9 mm Cu. A sharp penumbra is obtained through the small focal spot and the use of beam defining diaphragms pivoted at target level. Central axis dosage measurements give a build-up peak at 1 cm depth in water, and the dose at 10 cm depth for a 10 × 10 cm field is 62.8 per cent. The surface dose for this same size field is 17 per cent, largely due to secondary electrons from the air. Isodose curves were obtained by direct measurement and also by calculation from the central axis data and some typical curves for oblique fields, fields applied to curved surfaces and wedge fields are also given. The low proportion of scatter, coupled with the optical setting up facilities as well as the precision movement of the machine make for accurate beam direction and allow the irradiation of most deep seated tumours to a high dosage level. The reliability is such that serious interruptions of treatment have occurred on only one or two days per year. (auth)

2921

WEDGE FILTERS FOR USE ON THE 8 Mev LINEAR ACCELERATOR. P. E. Francois (Hammersmith Hospital. London). Brit. J. Radiol. 31, 712-13(1958) Dec.

Full-size filters made of aluminum, steel, and lead, each a simple wedge with an angle of 45 degrees, were designed to turn the central parts of the isodose curves from the x-ray beam of an 8-Mev linear accelerator. Details of construction are described, and the typical isodose distribution obtained is presented graphically. (C.H.)

2922

OSCILLATIONS IN THE OMEGATRON. L. R. McNarry (National Research Council, Ottawa). Can. J. Phys. 36, 1710-13(1958) Dec.

The experiments discussed tend to disprove the hypothesis that ion-orbit drift is the cause of background ion current in the omegatron. The following effects were observed: (1) The minimum delay before the onset of instabilities is 5 μsec. (2) Electron current oscillations stabilize in $\sim$50 μsec. (3) Electron current oscillations reach maximum amplitudes in $\sim$80 μsec. (4) Positive ion current starts at $\sim$90 to 100 μsec. (5) Positive ion current reaches its maximum amplitude in $\sim$1 μsec. (T.B.A.)

2923

ARRANGEMENT FOR RECORDING THE α RADIOACTIVITY IN THE BLOOD OF RATS. Jacques Lafuma. Compt. rend. 247, 1788-9(1958) Nov. 17. (In French)

The passage in the blood of an alpha-emitting aerosol which was inhaled was measured in a little cell attached to the carotid. A wall of the cell is formed by the window of a Geiger-Mueller counter functioning as a proportional counter. The background noise of the apparatus is less than 2 pulses/hr. One can easily detect 10^{-5} μ c/ml of an alpha emitter of 5 Mev in spite of the short track of alpha particles in the blood. (tr-auth)

2924

ARRANGEMENT FOR RECORDING THE β RADIOACTIVITY IN THE BLOOD OF THE RAT. Georges Michon. Compt. rend. 247, 1789-92(1958) Nov. 17. (In French)

A blood shunt on a single carotid is established and the blood travels through one of two cells connected in such a manner that a Geiger-Mueller counter with a thin window detects the particles emitted by the blood. The arrangement can detect 10^{-3} μ c/ml in the blood for a beta emitter of 0.6 Mev maximum energy. The arrangement also allows the differential recording of two radioelements in which the radiation energies are different. (tr-auth)

2925

CONSTRUCTION OF A MEASUREMENT ARRANGEMENT FOR THE 4π COUNTING OF RADIOISOTOPES. G. Krüger (Deutschen Akademie der Wissenschaften, Berlin). Exptl. Tech. Phys. 6, 109-19(1958). (In German)

A 4π methane flow-through counter is described. It is used for the determination of the absolute decay rate of radioisotopes which emit a particle during decay. The counter is so designed that routine measurements at lost cost are possible. (tr-auth)

2926

DESCRIPTION OF A LOW-TEMPERATURE X-RAY CAMERA. Manfred Dietze. Exptl. Tech. Phys. 6, 120-4(1958). (In German)

A description is given of a low-temperature x-ray camera which can also be used at room temperature. (J.S.R.)

2927

THE IONIZATION CHAMBER AS A MEASURING APPARATUS FOR CONTINUOUS RECORDING OF COSMIC RADIATION. W. Messerschmidt (Martin-Luther-Univ., Halle, Ger.). Exptl. Tech. Phys. 6, 145-56(1958). (In German)

In 1955 four ionization chambers were placed at a height of 100 m for the continuous recording of cosmic radiation. The building of the installation, the construction of the ionization chambers, and the experiments made with the chambers are described. (J.S.R.)

2928

SCATTERING OF 3.27-Mev NEUTRONS BY DEUTERONS. H.-J. Gerber, M. Brüllmann, and D. Meier (Physikalisches Institut der ETH, Zurich). Helv. Phys. Acta 31, 580-3(1958). (In German)

The polarization for the elastic scattering of neutrons by deuterons was measured at the angle of 53° with a fast time-of-flight apparatus (Helv. Phys. Acta 31, 318(1958)). In the present article, the electronic circuitry of the spectrometer is described, and its characteristics are given. (J.S.R.)

2929

PRESSURE DEPENDENCE OF THE SATURATION CHARGE OF Po α PARTICLES IN CO_2, A-CO_2, AND A-CH_4 MIXTURES. F. Widder and P. Huber (Univ. of Basel). Helv. Phys. Acta 31, 601-24(1958). (In German)

The anomalous dependence of the saturation charge of Po α-particles on pressure in ionization chambers filled with CO_2 is examined. For this purpose new measurements were made with carefully purified CO_2. By means of the theory of G. Jaffé, a graphic representation of saturation curves could be found, which gives a saturation charge independent of pressure. There the dependence of the mobility of electrons on field strength must be taken into account. Moreover mixtures of 95% A + 5% CO_2, 70% A + 30% CH_4 and 80% A + 20% CH_4 are investigated. These gas mixtures also show a dependence of the saturation charge on Po α-particles on pressure when the dependence of the mobility of electrons on field strength is neglected. By taking into account the varying mobility of electrons, this dependence on pressure vanishes in the case of A-CO_2 mixture and is strongly reduced in the case of A-CH_4 mixtures. For the average energy loss per ion pair of Po α-particles the following values are found: CO_2: 34.0 ± 0.3 ev; 95% A + 5% CO_2: 25.22 ± 0.11 ev; 70% A + 30% CH_4: 27.43 ± 0.10 ev; 80% A + 20% CH_4: 27.17 ± 0.12 ev (auth)

2930

CONTRIBUTION TO THE STUDY OF PHOTOMULTIPLIERS. P. Cachon and A. Sarazin. J. phys. radium 19, 792-3(1958) Oct. (In French)

A study was made of the response of a photomultiplier to an incident luminous pulse and of the deformations which the pulse causes. The variations in the transit time of the photomultiplier and in the sensitivity of the photocathode were determined as a function of the point of impact on the photocathode. (J.S.R.)

2931

SECTOR TYPE DOUBLE FOCUSING BETA RAY SPECTROMETER. PART I. GENERAL PROPERTIES. Mitsuo Sakai and Hidetsugu Ikegami (Univ. of Tokyo). J. Phys. Soc. Japan 13, 1076-9(1958) Oct.

A small scale beta ray spectrometer was built, making use of the double focusing principle applied to sector-field. The fringing field was found to be easily corrected and not to be serious for conventional purposes. The gathering power of 0.3% was obtained for the resolving power of 0.7%. Since the source can be placed outside of the magnetic field, this type of spectrometer might serve as a powerful tool for coincidence and correlation measurements. (auth)

2932

SECTOR TYPE DOUBLE FOCUSING BETA RAY SPECTROMETER. PART II. TWIN SETTING MEASUREMENT OF THE WEAK HIGHER COMPONENT OF Cs^{137} Toshimitse Yamazaki, Hidetsugu Ikegami, and Mitsuo Sakai (Univ. of Tokyo). J. Phys. Soc. Japan 13, 1080-3 (1958) Oct.

A twin setting of two sector type double focusing beta ray spectrometers was used for measurement of the weak higher component of Cs^{137} in order to remove completely the contributions resulting from the secondary causes. The measured spectrum agreed well with those of the previous results, which were therefore confirmed to provide a reliable basis for the analysis of the coupling constants in beta decay. (J.E.D.)

2933

A CRYOSTAT FOR REACTOR IRRADIATIONS IN LIQUID NITROGEN. M. W. Thompson and D. W. Jefferson-Loveday (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr. 35, 397-9 (1958) Nov.

A liquid nitrogen cryostat which has operated inside the BEPO reactor at Harwell is described. Provision was made for removing irradiated specimens in liquid nitrogen after periods of up to one month. Some difficulties encountered and the methods used to overcome them are discussed. (auth)

2934

A VARIABLE RADIO-FREQUENCY INDUCTANCE FOR THE BIRMINGHAM PROTON SYNCHROTRON. P. H. Rose (Univ. of Birmingham, Eng.). J. Sci. Instr. 35, 399-402(1958) Nov.

An inductance capable of varying from 26 to 0.033 μH is described. The variation is achieved by saturating a ferroxcube core in a coaxial cavity by means of a large biasing current passing down the center of the inner conductor of the cavity. The inductance is used to tune the Cee of the Birmingham proton synchrotron over the frequency range 0.3 to 9.6 Mc/s. It is operated at a power level up to 40 kva. The method and circuits by which the bias current is controlled to give the desired inductance at any frequency are also explained. (auth)

2935

THE USE OF ARGON AT ATMOSPHERIC PRESSURE AS GEIGER COUNTING GAS IN A WINDOWLESS COUNTER. S. Lovett (Microbiological Research Establishment, Porton, Salisbury, Wilts, Eng.). J. Sci. Instr. 35, 422-3(1958) Nov.

When operated with the usual electronic scaling equipment, the counter described gives a Geiger plateau extending from 1950 to 2250 v with a slope of less than 3% per 100 v. At an operating potential of 2080 v a background of 14 counts/min was recorded behind 3 cm of lead. Samples containing C^{14} counted in the windowless counter gave 2.5 to 3 times the count obtained with a thin end-window counter. (auth)

2936

INDUSTRIAL APPLICATIONS OF RADIOISOTOPES, NUCLEAR LIQUID LEVEL GAUGES. Stelios Regas (Radiation Counter Labs., Skokie, Ill.). J. Soc. Non-Destructive Testing, 16, 493-4(1958) Nov-Dec.

Some general properties of radioisotopes and their applications to the field of measurements are reviewed. The operation of nuclear devices in determining the level of a liquid in a container is explained in detail. Two types of level gages, the Predetermined Liquid Level Gage and the Continuous Level Gage, are included in the discussion. (J.H.M.)

2937

SHAPING PULSES FOR NUCLEAR SPECTROMETRY. Robert L. Chase (Brookhaven National Lab., Upton, N. Y.). Nucleonics 16, No. 11, 116-19(1958) Nov.

Four passive-element circuits commonly used to remodel radiation-detection pulse-height analyzers are discussed. These are: single-RC differentiation, double-RC differentiation, delay-line differentiation, and double delay lines. A table identifies and compares the four pulse-shaping systems with respect to pulse duration, base-line stability, pile-up overloading, low-frequency noise, and midbank noise. Figures show the pulse shape obtained for the various arrangements. The advantages and disadvantages of each method are given. (T.B.A.)

2938

MAGNETIC TAPE SIMPLIFIERS HANDLING OF NUCLEAR DATA. D. W. Halfhill (Ampex Corp., Redwood City, Calif.). Nucleonics 16, No. 12, 55-7, 66(1958) Dec.

Information is presented on methods and uses of magnetic-tape recording for handling nuclear data. Discussions are included on types of recording such as direct, frequency modulation, pulse-duration modulation, and digital. This information-storage medium is appropriate for the following purposes: to record data for which other media do not have necessary frequency response or date-handling capacity; to speed up or slow down information transfer; to log large volumes of data in short times; to record data that must be recreated in "live" form; and to store information that must be available for immediate playback or erased, modified or updated. (J.H.M.)

2939

MEASURING γ-RAY SPECTRA WITH LARGE PLASTIC SCINTILLATORS. G. L. Brownell and W. H. Ellett (Massachusetts General Hospital, Boston) and H. D. LeVine (U. S. Atomic Energy Commission, New York). Nucleonics 16, No. 12, 68, 70(1958) Dec.

Investigations were made of the Compton spectra produced in a 16-in.-diameter by 8-in.-long cylindrical plastic scintillator coupled to a 16-in. Du Mont photomultiplier for maximum light collection. The spectra obtained with this equipment are shown, and comparisons are included of NaI and plastic scintillators. (J.H.M.)

2940

IMPROVED MASTER-SLAVE MANIPULATOR HAND. W. H. Leith (E. I. du Pont de Nemours & Co., Aiken, S. C.). Nucleonics 16, No. 12, 70-1(1958) Dec.

A new hand has been developed for the Argonne-type master-slave manipulators in use at the Savannah River Laboratory. An innovation in the hand is the flexibility provided by detachable fingers. An important advantage is the protection afforded moving parts of the hand against contamination by the gauntlet. The hand is now standard on all new SRL manipulators. (C.W.H.)

2941

EFFECTS OF THE DIAPHRAGMS ON THE SENSITIVE LAYER OF DIFFUSION CHAMBER. A. P. Komar and M. V. Stabnikov (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 21-4 (1958) Sept. (In Russian)

A design is offered of lead diaphragms producing only slight distortions on the sensitive layer. (tr-auth)

2942

APPLICATION OF RADIOACTIVE ISOTOPES IN DETERMINING THE PHOTOEMULSION SENSITIVITY. K. V. Starinin (Inst. of Scientific Research in Cinema-Photography). Pribory i Tekh. Ekspt. No. 5, 25-8(1958) Sept. (In Russian)

Effective application of electrons (with minimum relativistic energies 1.5 to 2.5 Mev) from prepared radioactive isotopes for determining the photoemulsion sensitivity was investigated. The low-energy electron tracks near the surface of the emulsion were expressed as rectilinear sections of 170 to 350 μ which is much shorter than a total electron path. At 2.5 Mev these sections (mean length $\sim 350\mu$) can be used in determining the sensitivity of an emulsion with thickness not over 100 μ. (tr-auth)

2943

ENERGY RESOLUTION OF SCINTILLATION COUNTER WITH LIGHT YIELD FROM BOTH FACES OF THE CRYSTAL. V. R. Burmistrov. Pribory i Tekh. Ekspt. No. 5, 30-2(1958) Sept. (In Russian)

Improvements of energy resolution are suggested for scintillation counters with light yield from both faces of the crystal and for an ordinary scintillation counter. Increased light collection is accomplished by replacement of the reflector on the second face of the ordinary crystal with the photocathode of the second photomultiplier and combining pulses from both photomultipliers. (tr-auth)

2944

ON THE INFLUENCE OF PULSE ANALYZER CHANNEL WIDTH ON THE SCINTILLATION SPECTROGRAPH RESOLVING POWER. Yu. A. Tsirlin (All-Union Research Inst. of Chemical Reactives, Kharkov). Pribory i Tekh. Ekspt. No. 5, 34(1958) Sept. (In Russian)

2945

CALCULATION LOSSES IN MULTICHANNEL AMPLITUDE ANALYZERS USING PERIODIC MEMORY DEVICES. V. O. Vyazemskii (Leningrad Electro-Technical Inst.). Pribory i Tekh. Ekspt. No. 5, 35-40(1958) Sept. (In Russian)

Formulas are derived combining the integral count velocity and the mean frequency of incoming pulses for four types of analyzers using periodic momory devices. The formulas permit the determination of the count losses and the rational selection of incoming pulse frequencies in relation to the type of entrance used in the analyzer. (tr-auth)

2946

NON-OVERLOADING AMPLIFIER WITH WIDE CHANNEL DISCRIMINATOR. V. Ya. Vyazemskii, L. V. Drapchinskii, et al. (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 40-4(1958) Sept. (In Russian)

Descriptions are given of a non-overloading linear amplifier with amplification coefficient 2×10^3, rise time less than 0.2 μsec, and an integrally wide channel pulse discriminator. (tr-auth)

2947

PULSE-MODULATED GENERATOR WITH QUARTZ CRYSTAL. V. V. Okorokov. Pribory i Tekh. Ekspt. No. 5, 45-8(1958) Sept. (In Russian)

The pulse-modulated generator described employs a quartz diaphragm with natural frequency 1 mhz serving as the excitation element. The sinusoidal oscillations in the shock-excited quartz, after amplification, form a finite series of narrow pulses with 1 μ sec intervals. (tr-auth)

2948

INVESTIGATIONS OF RESOLVING TIME OF SPARK COUNTERS. L. I. Artemenkov and M. V. Babykin. Pribory i Tekh. Ekspt. No. 5, 48-53(1958) Sept. (In Russian)

Parallel-plate spark counters with working slits 0.3 mm, filled with argon and oxygen gas mixtures under total pressure of 2 to 3 atm. were investigated. The pulses from the counter entered into the scheme of retarded coincidences. The curve width at the half height was $\sim 3 \times 10^{-10}$ sec. (tr-auth)

2949

UNIVERSAL NUCLEAR MAGNETOMETER. Yu. N. Denisov (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 5, 67-70(1958) Sept. (In Russian)

A universal apparatus for measuring constant magnetic fields based on the principle of nuclear resonance absorption is described. A range of 300 to 20,000 oe can be measured. The permissible inhomogeneity of magnetic fields in the transducer region is 4 to 5% of the measured value. The order of precision is $\pm$ 0.001%. The measurements are practically "point measurements" as the volume of the specimen, in which the nuclear absorption resonance is observed, varies at different ranges from 0.0002 to 0.01 cm^3. A four mole aqueous solution of $Fe_2(SO_4)_3$ is used as a specimen. (tr-auth)

2950

NEW METHOD FOR MEASURING UNIFORM AND NON-UNIFORM MAGNETIC FIELDS BASED ON MAGNETIC RESONANCE OF PROTONS. A. I. Zhernovoi, Yu. S. Egorov, and G. D. Latyshev (Leningrad Inst. of Transportation). Pribory i Tekh. Ekspt. No. 5, 71-2(1958) Sept. (In Russian)

A measuring method is suggested for uniform and non-uniform magnetic fields based on the mutation of the total magnetic moments of protons. (R.V.J.)

2951

MEASUREMENTS AND STABILIZATION OF WEAK MAGNETIC FIELDS BASED ON MAGNETIC RESONANCE OF PROTONS. A. I. Zhernovoi, Yu S. Egorov, and G. D. Latyshev (Leningrad Inst. of Transportation). Pribory i Tekh. Ekspt. No. 5, 73-5(1958) Sept. (In Russian)

Descriptions are presented of measurements and stabilization of weak uniform magnetic fields starting at 5 oe. The order of precision in measurements of magnetic field intensity at the lower limits is $\sim 10^{-4}$ and increases with the increase of the field. Stabilization is fulfilled starting with 12 oe. Stabilization coefficient of the lower limit is 300. (tr-auth)

2952

AUTOMATIC SCANNING OF MC-2M MASS SPECTROMETER MAGNETIC FIELD. S. S. Yastrebov. Pribory i Tekh. Ekspt. No. 5, 76-8(1958) Sept. (In Russian)

An apparatus is described for automatic adjustment of

the MC-2M mass spectrometer magnetic field. The apparatus scans the mass spectrometer with a maximum reduced time interval between recordings of the periodically occurring spectra, by altering the magnetic field at narrow intervals. (tr-auth)

2953

ADJUSTMENT FOR EEM-75 ELECTRON EMISSION MICROSCOPE FOR VISUAL STUDIES OF SURFACES BY MEANS OF SECONDARY ELECTRON EMISSION. I. S. Sbitnikova, E. M. Dubinina, G. V. Spivak, and D. V. Fetisov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 5, 78-82(1958) Sept. (In Russian)

An adjustment is designed for the thermoemission electron microscope which facilitates the visual study of microgeometry and the emission spectra of the thermal cathodes. This in turn permits the juxtaposition of electron emission centers with the microgeometry of the active thermal cathodes. The surface of the thermal cathode is subjected to irradiation by the electron beam from electron cannon which emits the beam at an angle to the surface. The apparatus is capable of adjusting the angle, formed by the electron cannon and microscope optical axis, from 85 to 45°. This leads to selection of the best irradiation conditions for producing sharp contrasting images on the various depths of the micro relief. The altered construction of the immersion object produces images of second and thermal emissions. (tr-auth)

2954

DEVELOPMENT AND LUMINESCENCE PROPERTIES OF CsI CRYSTALS. N. K. Pereyaslova and G. A. Kirdina (Inst. of Applied Geophysics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 86-90 (1958) Sept. (In Russian)

Data are presented on the technology of CsI crystal development in a closed container and on the spectrometric properties of the prepared crystals. (R.V.J.)

2955

MULTICHANNEL PULSE ANALYZER. N. P. Glazkov. Pribory i Tekh. Ekspt. No. 5, 97-8(1958) Sept. (In Russian)

Descriptions are given of a simple 20-channel pulse analyzer. The amplitude-time transformation circuit and mechanical counter are collected in four tubes. Resolving time is 0.02 sec. (tr-auth)

2956

MEASUREMENTS OF HETEROGENEOUS CONSTANT MAGNETIC FIELDS. G. K. Ul'yanov and K. N. Vinogradov (Leningrad Inst. of Shipbuilding). Pribory i Tekh. Ekspt. No. 5, 102-4(1958) Sept. (In Russian)

The apparatus for measuring sharply heterogeneous constant magnetic fields employs a wire transducer. Curves of dependence of magnetic field distribution at the magnet system gap on the pole piece angle of deflection are plotted. (tr-auth)

2957

FINE α ACTIVE LARGE AREA SOURCES. G. A. Korolev and G. E. Kocharov (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 108-9(1958) Sept. (In Russian)

A new method is offered for preparation of fine film α-active sources with large area and good homogeneity. The sources are prepared by electrical precipitation of α-active substances on aluminum-coated films of zapon lacquer. The total thickness of films is less than 50 $\mu g/cm^2$. The method is simple and does not require any special apparatus. (tr-auth)

2958

IONIZING MANOMETER CALIBRATIONS ACCORDING TO SOME HALIDE CONTAINING GASES. N. S. Buchel'nikova (Inst. of Chemical Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 110(1958) Sept. (In Russian)

Correction coefficients for calibrations for air, Cl_2, Br_2, and HCl are tabulated. (R.V.J.)

2959

CURRENTS INDUCED IN THE DIELECTRICS OF IONIZATION CHAMBERS THROUGH THE ACTION OF HIGH-ENERGY RADIATION. H. E. Johns, N. Aspin, and R. G. Baker (Univ. of Toronto). Radiation Research 9, 573-88(1958) Dec.

The polarity effect in ion chambers is caused by the interaction of the high-energy radiation with the collecting electrode. This effect is most marked when conditions of electronic equilibrium are not established in the back wall of the ion chamber. Calculations of the polarity effect have been made which agree with measured values. Two sets of curves are presented which enable the polarity effect to be quickly calculated for parallel-plate ion chambers measuring cobalt-60 radiation. (auth)

2960

RADIATION DOSIMETRY BY TRANSPARENT PLASTICS. J. W. Boag, G. W. Dolphin, and J. Rotblat (Univ. of London). Radiation Research 9, 589-610(1958) Dec.

The radiation-induced ultraviolet absorption in transparent plastics has been investigated in detail and found to be a convenient, rapid, inexpensive, and accurate method of measuring radiation doses between 10^5 and 2×10^8 rads. In methyl methacrylate (Perspex) the change in optical density at 2920 A is a linear function of the dose, up to about 3 megarads, and of the inverse of the thickness of the sample. Various factors that may influence the reproducibility of results have been investigated. The calibration curve, relating the change in optical density to the dose in rads, measured calorimetrically, is given. In polyethylene terephthalate (Melinex), which can be obtained in thin foils, the induced absorption was measured at 3250 A and calibration curves obtained up to 200 megarads. The rate of fading of the induced absorption and its bearing on the results are discussed. Some examples are given of the application of this technique to dosimetry. (auth)

2961

SPHERICAL ELECTRON-PULSE IONIZATION CHAMBERS FOR FAST NEUTRON INVESTIGATIONS. V. P. Vertebnii, M. F. Vlasov, M. V. Pasechnik, and I. A. Totskii. Ukrain. Fiz. Zhur. 3, 196-203(1958) Mar.-Apr. (In Ukrainian)

The design of spherical high-pressure methane electron-pulse ionization chambers for neutron measurements is described. The calculation of the induction effect and some experimental characteristics of the chambers are given. (tr-auth)

2962

METHOD OF IONIZATION RECORDING IN THE APPLIED X-RAY STRUCTURE ANALYSIS. SURVEY. L. I. Mirkin. Zavodskaya Lab. 24, 569-76(1958).

A survey is presented of the equipment and techniques used in the ionization method for x-ray structure analysis. 53 references. (J.S.R.)

METALLURGY AND CERAMICS

Refer also to abstract 3456.

2963 AD-41853

Carborundum Co. Research and Development Div., Niagara Falls, N. Y.

BORON NITRIDE AND REFRACTORY BODIES CONTAINING BORON NITRIDE. Final Report for the Period June 22, 1950 to June 21, 1951. 58p.

Three methods of making boron nitride were experimentally investigated, and the properties of the product obtained by one of these was studied. A variety of refractory bodies containing boron nitride as the major or minor constituent was developed, and a preliminary study was made of the physical properties of some of these. Small experimental rocket nozzles, representing four of the most promising bodies, were produced for firing tests. (auth)

2964 AFOSR-TN-58-129

Illinois. Univ., Urbana.

FATIGUE AND INTERNAL STRESS ANALYSIS OF CERAMIC COATED METAL COMPOSITES. Report No. 83. J. H. Lauchner and D. G. Bennett. Sept. 1958. 37p. Contract AF-18(603)-28. (AD-203494).

Ceramic coated metal composites were studied in regard to their behavior under mechanically and thermally induced stresses. Residual coated metal system stresses were measured as a function of temperature and integrated with analysis of thermal shock, static and repeated loadings. Coating metal interfacial structure considerations indicate a saturation of the glassy phase by oxides of the base metal accompanied by the presence of residual strain gradients essentially within the interfacial zone. Theoretical analysis of flat plate coated metal composites was found to be in close agreement with experimental results obtained from annealed coated metal specimens in the absence of viscous or plastic flow. Cobalt bearing vitreous ceramic coatings were observed to fracture when strained approximately 1,000 micro inches per inch in tension or 10,000 micro inches per inch in compression under room conditions and finite straining periods. The maximum induced strain (thermal or mechanical) which cobalt bearing ceramic coatings could withstand without fracture was found to be a function of residual stress. (auth)

2965 AGARD-159

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

CORROSION SECHE ET PROTECTION DES ALLIAGES REFRACTAIRES Ni—Cr 80/20. RELATION AVEC LA FATIGUE ET LE FLUAGE. (Dry Corrosion and Protection of the Refractory Alloy, 80/20 Ni—Cr. Relation with Fatigue and Creep.) M. Mathieu. Nov. 1957. 26p.

The reasons for the rupture of blades made from forged heat-resistant alloys of the Ni—Cr 80/20 type were investigated. The development of the internal structure of the metal under work conditions was studied. The appearance of corrosion in the alloy because of the effect of air and combustion gases was investigated. No particular features were observed in the case of combustion gases or in the case of air. There was no difference in the occurrence of creep and fatigue phenomena on specimens in air and in combustion gases. The effect of work-hardening on structure development and on corrosion was investigated. It was shown that the areas of non-uniformity in the structure caused by too severe work-hardening may create points at which corrosion starts. A surface treatment is suggested for the protection of alloys against crack corrosion. (tr-auth)

2966 AGARD-185

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

A REVIEW OF THE DEVELOPMENT OF CERMETS. G. C. Deutsch, A. J. Meyer, Jr., and G. M. Ault. [1958]. 26p.

Presented at the Seventh Meeting of the Structures and Materials Panel, Mar. 24, to Apr. 3, 1958, Rome.

Cermet materials are defined, and the development of different varieties of cermets are discussed. The physical and mechanical properties of cermets are dealt with, with special reference to the normally poor impact strength and ductility of these materials. Possible ways are considered in which these two properties might be improved. (auth)

2967 ANL-5797

Argonne National Lab., Lemont, Ill.

METALLURGY DIVISION QUARTERLY REPORT [FOR] JULY, AUGUST, AND SEPTEMBER 1957. Oct. 1958. 58p. Contract W-31-109-eng-38. $1.75(OTS).

Advanced Water Reactor Program. Three firings were made of initial closed-porosity fuel pellet bodies. Each firing contained pellets of the composition 90 wt. % ThO_2—10 wt. % UO_2 with various additives and firing variables. Fast Power Breeder Reactor Program. To determine the potential usefulness of a Zr—5 wt. % Pu alloy, the fabricability of the alloy was tested. The manufacture of rod stock from which fuel and blanket elements for the Mark III loading of the EBR-1 were produced has been completed. The effect of irradiation on extruded and heat-treated U—2 wt. % Zr alloy for the EBR-1 is reported. Fabrication procedures for making graphite—U_3O_8 test specimens for the TREAT Reactor were investigated. Advanced Engineering and Development. Ultrasonic bond tests were conducted on 590 EBR-1 Mark III blanket fuel elements. The blanket rods and part of the fuel rods for the EBR-1 Mark III loading are being checked for cladding thickness by an eddy current system. Investigations of corrosion-resistant Zr—Nb alloy were continued. Corrosion of Mg alloys is being studied in support of the Mighty Mouse reactor program. Dynamic corrosion tests were performed on aluminum alloys, and results are included. Production, Treatment, and Properties of Materials. The progress of the program of preparing high-purity Pu by fused salt electrolysis is summarized. Velocities of ultrasonic waves propagated in directions suitable for determining the room-temperature elastic moduli C_{12}, C_{13}, and C_{23} of alpha U were determined. The investigation of recrystallization in heavily cold-rolled alpha-uranium sheet without a texture change was essentially concluded during this quarter. Self-diffusion runs in polycrystalline uranium in the gamma phase, using the sputtering technique, have yielded a tentative value for the diffusion coefficient between 10^{-6} and 10^{-7} cm^2/second. The preparation of high-purity U—Pu alloys is reported. The data for the alpha-to-beta transformation temperatures in high-purity U and U—C alloys were confirmed by experiments on new specimens. Microstructure, density, and thermal arrest data were obtained for several injection cast, nominal U—5 wt. % fissium and U—8 wt. % fissium alloys. Phase diagrams are presented for U—Mo and U—Ru alloys. Alloy Theory and The Nature of Solids.

Four new isomorphs of Ti_2Ni have been discovered. Effects of Irradiation on Materials. The experimental and analytical work on the radial distribution of thermal neutrons within cylindrically shaped fuel specimens during irradiation was completed. (For preceding period see ANL-5790.) (W.L.H.)

2968 BMI-1125
Battelle Memorial Inst., Columbus, Ohio.
THE HEAT TREATMENT, TRANSFORMATION REACTIONS, AND MECHANICAL PROPERTIES OF SOME HIGH-STRENGTH ZIRCONIUM-BASE ALLOYS. Herbert A. Robinson, J. Robert Doig, Morris W. Mote, and Paul D. Frost. Aug. 9, 1956. 62p. Contract W-7405-eng-92. $10.80(ph OTS); $3.90(mf OTS).

Zirconium alpha-beta alloys were found to respond to solution and aging heat treatments very similarly to titanium alpha-beta alloys. A zirconium–5 wt. % molybdenum–2 wt. % tin alloy was heat treated to a 168,500-psi tensile strength and a 153,500-psi yield strength, with 11.5% elongation in 1 in. In addition, a zirconium–5 wt. % niobium–2 wt. % tin alloy was heat treated to a 190,500-psi tensile and a 178,000-psi yield strength, with 2% elongation. The transformations that occur upon aging these alloys may be represented as follows: $\beta \rightarrow \omega + \beta_r \rightarrow \alpha + \beta_u$ and $\alpha' \rightarrow \alpha + \beta_r$. Preliminary elevated-temperature properties were very good. The zirconium–5 wt. % molybdenum–2 wt. % tin alloy solution treated at 1525°F and aged 8 hr at 1000°F was evaluated for tensile strength and 100-hr rupture life at 840°F. The tensile strength, yield strength, and elongation were 111,000 psi, 84,500 psi, and 12%, respectively. The 100-hr rupture strength was about 95,000 psi. (auth)

2969 BMI-1298
Battelle Memorial Inst., Columbus, Ohio.
CONSTITUTION, METALLURGY, AND OXIDATION RESISTANCE OF IRON–CHROMIUM–ALUMINUM ALLOYS. Walston Chubb, Sam Alfant, Arthur A. Bauer, Edward J. Jablonowski, Fred R. Shober, and Ronald F. Dickerson. Oct. 16, 1958. 105p. Contract W-7405-eng-92. $2.50(OTS).

The constitution of iron–chromium–aluminum alloys was investigated employing high-purity materials. Ternary sections illustrating the results are presented. The limits of the alpha-plus-sigma region are found to extend from 33 to 63 wt. % chromium at 600°C. At 750°C these limits decrease to 38 and 57 wt. % chromium. Sigma is found in alloys containing a maximum of about 9 wt. % aluminum at 600°C and 4 wt. % aluminum at 750°C. The limits of the alpha solid-solution region were investigated between 500 and 900°C. No observable change in limits occurred between 500 and 750°C. However, between 750 and 900°C the $AlCr_2$ phase decomposes resulting in a slightly expanded alpha region in the high-chromium alloys. Sigma is found to be unstable below 600°C in alloys of sigma-phase composition. Sigma formation and decomposition occur reversibly above and below this temperature. The nature of the products of the reaction below 600°C has not been determined. A detailed investigation of the physical metallurgy of iron alloys containing 25 to 35 wt. % chromium and 3 to 8 wt. % aluminum has been made in an attempt to define the limits of usefulness of these materials as structural materials. It is possible to melt and fabricate all alloys within this composition range, but extraordinary care must be used to avoid embrittlement from undesirable impurities such as carbon, from oxide drosses, from unfavorable grain size and structure, and from internal cracking caused by rapid cooling. Suitable methods for casting and fabricating these alloys are described. The deformation processes of iron–chromium–aluminum alloys are reported and a ductility transition which varies with alloy content is attributed to the interaction of a twinning mode of plastic deformation and a cleavage mode of fracture. The oxidation resistances of iron-23.7 wt. % chromium-6.0 wt. % aluminum alloy and of nickel-20.0 wt. % chromium-1.1 wt. % niobium alloy have been compared at 1040 and 1150°C in air atmospheres containing additions of (1) water vapor, (2) carbon dioxide, and (3) combinations of water vapor and carbon dioxide. The iron–chromium–aluminum alloy was more oxidation resistant than the nickel–chromium–niobium alloy in all atmospheres at 1150°C. Minimum oxidation of both alloys occurred in an atmosphere of air plus 2.5 vol. % water vapor. (auth)

2970 CF-58-10-83
Oak Ridge National Lab., Tenn.
HRE-2 CORROSION SPECIMENS–BLANKET REGION OF PRESSURE VESSEL (LOADING NO. 1)–WEIGHT DATA AND SCALE ANALYSIS. A. R. Olsen. Oct. 31, 1958. 13p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS)

Specimens (type 347 stainless steel, zirconium alloys, and titanium alloys), exposed in the Blanket region of the HRE-2 during runs 13 and 14 as well as during some prior high temperature operations, were examined and weighed. The visual observations and weight data are presented together with the chemical analyses of scale removed from some of these specimens. The evidence indicates that the corrosion of the specimens was moderate. Some possible interpretation of the results of the scale analyses as related to core tank corrosion are also reported. (auth)

2971 CF-58-10-86
Oak Ridge National Lab., Tenn.
DEPLETION OF MINOR CONSTITUENTS FROM COAST METALS NO. 52 (89 Ni–5 Si–4 B–2 Fe) AND NO. 53 (81 Ni–8 Cr–4 B–4 Si–3 Fe) BRAZING ALLOYS DURING VARIOUS EXPOSURES. D. H. Jansen. Oct. 23, 1958. 15p. $3.30(ph OTS); $2.40(mf OTS).

Corrosion tests were made on nickel-base brazing alloys containing boron and silicon in fused fluoride fuels, liquid metals, and oxidizing atmospheres. Impoverished regions, after the tests, contained approximately one third the original amount of boron and silicon that was present before the tests. (A.C.)

2972 CF-58-11-49
Oak Ridge National Lab., Tenn.
HOLE FORMATION IN THE HRT CORE TANK. H. C. Claiborne. Nov. 18, 1958. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

By making justifiable assumption with regard to nucleate boiling, the thickness of uranium-bearing deposits required to melt the core tank are calculated as a function of U-deposition area and U^{235} density. The results demonstrate that small deposits of uranium-bearing material are sufficient to result in core melting. (auth)

2973 CF-58-11-70
Oak Ridge National Lab., Tenn.
HRP-PERFORMANCE OF CONTINENTAL COATINGS, INC. H_2–O_2 FLAME-SPRAYING EQUIPMENT FOR FLAME CALCINATION OF ThO_2. C. C. Haws.

Nov. 18, 1958. 10p. Contract W-7405-eng-26. $1.80 (ph OTS); $1.80(mf OTS).

A torch and feeding system for application of ceramic coatings to metal surfaces using a hydrogen–oxygen flame was tested for flame calcination of thoria. Feed of the dry thoria–graphite powder was excellent; the temperature of calcination obtained was not determined. (auth)

2974 CRE-701

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EXTRUSION CLADDING OF NRU FUEL ELEMENT. H. S. Milne. Apr. 1957. Changed from OFFICIAL USE ONLY Nov. 14, 1958. 37p. (AECL-519). $1.00(AECL).

A process has been developed for extruding the aluminum sheath directly on the core material. The process is accomplished by a vertical hydraulic press forcing preheated aluminum billets into a converging chamber of a die-block arrangment. Metal flows around the core material and welds into a continuous sheath over the core as the core is guided horizontally through the die. The size of the die aperture determines the thickness of the cladding. A solid aluminum plug is extruded prior to the core entering the die and again after the core has passed through the die. These plugs act as end seals, eliminating the need for welded end-closures. (A.C.)

2975 DMIC-Memo-3

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

RECENT ADVANCES IN TITANIUM TECHNOLOGY. Oct. 24, 1958. 34p.

A review of recent developments in titanium technology is presented. Several technological factors including production methods and techniques of melting, casting, and rolling are described. In addition, secondary forging, extrusions, sheet forming, machining and grinding, welding, and heat treating are discussed. Finally, alloy development is considered. Data are included in graphs and tables. (J.R.D.)

2976 HW-57130

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE TENSILE PROPERTIES OF PURE PLUTONIUM. H. R. Gardner and J. M. Jefferes. Aug. 6, 1958. 16p. Contract W-31-109-Eng-52. $0.50(OTS).

As-cast and as-cast delta-phase-annealed 0.250 and 0.500 inch diameter tensile specimens were tested at an average temperature of 31°C. The average tensile properties for as-cast plutonium of 99.50% purity, 19.50 g/cc density, and 270 DPH hardness are: ultimate strength, 62,000 psi; 0.02 per cent yield strength, 37,000 psi; modulus of elasticity, 13.8×10^6 psi; and modulus of resilience, 12.7 to 26.1 in.-lb/in.^{3}. A delta-phase anneal did not significantly alter the tensile properties of as-cast plutonium. (auth)

2977 IGRL-IB/R-15(2nd Ed.)

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

MATERIALS FOR USE IN NUCLEAR REACTORS. Information Bibliography. B. Yates. 1958. 56p. $0.63(BIS).

A bibliography of the choice and properties of reactor materials, excluding fuel materials except where coincidental, to be used in reactors and reactor environments is presented. 366 references. (J.R.D.)

2978 IGR-TN/C-298

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

THE METALLOGRAPHY OF REACTOR FUELS. A REVIEW OF PROGRESS TO 12.11.55. R. Doldon. Feb. 29, 1956. 16p. (IGC-FRFEWP/P-94).

A study has been made of the kinetics of the beta-alpha phase change in the uranium ½ at. % chromium alloy, and isothermal heat treatments have been shown to refine the coarse cast structure of this alloy. (auth)

2979 KAPL-M-AME-14

Knolls Atomic Power Lab., Schenectady, N. Y.

SUBSTITUTION OF ARGON FOR HELIUM IN CONTROLLED ATMOSPHERE WELDING. Harold E. Soisson. Oct. 20, 1958. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Specimens of Zircaloy-2 were welded in helium and argon atmospheres to compare the effects. After the welding operations the specimens were subjected to bend and corrosion tests and were examined by x-ray radiography. On the basis of these tests it was recommended that welding techniques be further developed using argon as the blanketing atmosphere. (J.R.D.)

2980 KAPL-M-JAO-1

Knolls Atomic Power Lab., Schenectady, N. Y.

STRENGTH CONSIDERATION OF G. E. ANP 81 BRAZE JOINT IN THE KAPL 37-3 PRESSURE VESSEL. J. A. Owens. Sept. 5, 1958. 41p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS)

Tests were run and a literature search made to demonstrate the strength of the filler material used in the KAPL pressure vessel assembly. (A.C.)

2981 KAPL-M-JRF-1

Knolls Atomic Power Lab., Schenectady, N. Y.

PREPARATION AND EVALUATION OF ZIRCALOY 2 POWDER BY MECHANICAL ATTRITIONING. J. R. Fascia. Nov. 3, 1958. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

At present, there is an increasing demand for Zircaloy-2 powder in development work for naval reactors. A process developed by Advanced Metallurgical Development personnel produced Zircaloy-3 powder by attritioning in a helium atmosphere. Preliminary investigation showed good corrosion resistance and reasonably good mechanical properties. An alternate method of producing Zircaloy-3 powder by hydride-dehydride process did not compare as favorably. Further evaluation of Zircaloy-2 powder produced by the attritioning process has been made over a sustained period of time in conjunction with development work by D1G Core Materials and Metallurgical Fabrication Development personnel on burnable poison plates. (auth)

2982 KAPL-M-RNH-4

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF ZIRCALOY II METAL POWDER MADE THE BURR WHEEL PROCESS. R. N. Honeyman. Nov. 3, 1958. 17p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

Zircaloy-2 powder made from chips produced by the Burr wheel process was evaluated for potential use as the matrix material for B_4C–Zircaloy-2 dispersions. The particle size distribution is excellent, and with three exceptions all other properties amply meet required specifications. The three exceptions include excessive weight gain in corrosion, high oxygen content, and low apparent density. (auth)

2983 LA-2035

Los Alamos Scientific Lab., N. Mex.

A REVIEW OF THE CORROSION BEHAVIOR OF URANIUM. James T. Waber. Apr. 1956. 42p. Contract W-7405-eng-36. $1.25(OTS).

Unpublished work on the corrosion of unalloyed uranium is summarized. Data are presented for dry air and oxygen and for attack by water, water vapor, and steam, as well as by moist air and helium. The role of lattice defects in the corrosion mechanism is also discussed. Particular attention has been given to the effects of impurities and test conditions on the rates of corrosion. The general inability to obtain reproducible data has been attributed to the influence of small obscure variations in the test procedure. The effects of intentional impurity additions appear to be small. (auth)

2984 NAA-SR-3205

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

STRESS-STRAIN-TEMPERATURE-TIME RELATIONSHIPS FOR REFRACTORY MATERIALS. R. D. Chipman. Dec. 1, 1958. 45p. Contract AT-11-1-GEN-8. $1.25(OTS).

Creep tests are proposed to determine the temperature and time dependence of gross mechanical behavior of refractories. Different types of tests are discussed briefly with respect to the economics of obtaining large quantities of creep data for engineering design use. To illustrate proposed methods, isothermal bending tests were conducted on some BeO and SiC bodies over a range of temperature from room temperature to 2730°F. Testing time varied from a fraction of a minute to 24 hours. In the bending apparatus SiC heating elements are used, two-point specimen loading is imposed at a constant rate, and deflection is recorded continuously. Testing procedures and their influence on data are described. Modulus of rupture and relatively short-time creep data are presented, and stress-strain-temperature-time relationships represented by such data are discussed. Limitations on the interpretation and use of these data are discussed, and the suggestion is made that bending creep data be applied only to bending studies. Parameters are derived which relate bending loading intensity to strain condition, temperature, and time. Future work is outlined. (auth)

2985 NAVORD-2686

Naval Ordnance Lab., White Oak, Md.

BISMANOL PERMANENT MAGNETS, EVALUATION AND PROCESSING. Edmond Adams and William M. Hubbard. Jan. 5, 1953. 20p.

Bismanol permanent magnets have been evaluated for stability under various operating conditions. The magnets showed a remarkable flux constancy over a wide temperature range after stabilization at low temperatures. There is some decrease in magnetic flux density at the low temperature; the exact flux loss being dependent on the temperature of stabilization. Because of their high coercive force, the magnets are extremely stable magnetically to shock, vibration, centrifugal force and stray magnetic fields. Except for a tendency to chip, bismanol magnets are sufficiently strong physically for most applications. Unprotected bismanol magnets corrode slightly at ordinary temperatures and humidity, and more rapidly at 95% humidity. Magnets with applied protective coatings remained stable at room temperatures and moderate humidities for the six-month test period. The processing techniques of bismanol magnets have been improved by eliminating magnetic separation. The new technique consists of the separation of excess bismuth from the melt by hot-pressing prior to pulverization. Present maximum value for the coercive force (Hc) is now 3650 oersteds and 4800 gauss for the residual flux density (Br). Various types of pulverizing equipment were also evaluated with respect to the magnetic properties of the resulting compacts. The methods of determining percentage purity (MnBi content), alignment and effective particle size in bismanol magnets are discussed. (auth)

2986 NAVORD-6132

Naval Ordnance Lab., White Oak, Md.

EFFECTS OF EXTREMELY HIGH TEMPERATURES ON MAGNETIC PROPERTIES OF CORE MATERIALS. Michael Pasnak and R. H. Lundsten. July 10, 1958. 65p.

An experimental study has been made of the effects of temperature on the magnetic properties of the following ferromagnetic alloys: Orthonol, 4-79 Mo Permalloy, 4750 AEM, L and Z Silectron, Transformer A, Audio Transformer A, 11.7 Alfenol, 15.5 Alfenol, 3% Mo Thermenol, 7-70 Perminvar, and Supermendur. Measurements were made of the d-c and 60 cps magnetic properties for the temperature range of 24°C to 800°C. The materials were also evaluated after several temperature cycles between 24 and 500°C. The results indicate that, at high induction levels, high temperature decreases the maximum and residual inductions from their 24°C values, and at small fields the induction increased with temperature. For all materials tested, with the exception of Supermendur and 11.7 Alfenol, the coercive force decreased with increase in temperature. The effects of temperature on the maximum permeability, causes it to increase with increasing temperature, however, as the Curie temperature was approached, the maximum permeability started to decrease. The initial permeability also increased with increase in temperature, but unlike the maximum permeability, it generally started to decrease at a greater rate and at lower temperatures than did the maximum permeability. Grain oriented materials were more affected by temperature cycling than were unoriented materials. The effects of temperature cycling on the magnetic properties generally appear as an increase in the coercive force with each temperature cycle, a decrease in the maximum permeability, a decrease in the residual flux density, and a decrease in the squareness ratio. (auth)

2987 NMI-1207

Nuclear Metals, Inc., Cambridge, Mass.

THE SOLID SOLUBILITIES OF IRON AND NICKEL IN BERYLLIUM. S. H. Gelles, R. E. Ogilvie, and A. R. Kaufmann. July 29, 1958. 36p. Contract AT(30-1)-1565. $1.00(OTS).

The solid solubility limits of iron in beryllium were determined between 850 and 1200°C by analysis of differential type multi-phase diffusion couples, using an x-ray absorption technique. The maximum value of the solubility limit was found to be 0.92 ± 0.02 at. % (5.46 wt. %) at the eutectic temperature 1225°C. The solubilities of nickel and beryllium were determined between 900 and 1200°C by the same technique and the maximum solubility was found to be 4.93 ± 0.01 at. % (25.2 wt. %) at the eutectoid temperature, 1065°C. A previously unreported high temperature phase which decomposes eutectoidally at 1065°C was found to exist in the beryllium-nickel system at a composition of approximately 8 at. % Ni (36 wt. %) by diffusion couple analysis. The presence of

this phase was confirmed by thermal analysis and metallographic analysis of the structure resulting from the eutectoid decomposition. (auth)

2988 NP-7025

Manufacturing Labs., Inc., Cambridge, Mass.

THE LATTICE STABILITY OF METALS. I. TITANIUM AND ZIRCONIUM. Technical Report No. 1. Larry Kaufman. Oct. 1, 1958. 40p.

The difference in free energy between the bcc and hcp modifications of titanium and zirconium have been calculated between 0 and 2000°K by using existing thermodynamic data. These results have been employed to investigate the energetics of the bcc $\rightleftharpoons$ hcp reactions in the Ti–Zr system and in a series of titanium-base alloy systems. It is found that the chemical driving force for martensitic bcc $\rightarrow$ hcp reactions in these systems is about 50 cal/mol. This value, compared to 300 cal/mol for iron-base alloys, can be explained by the difference in physical characteristics of martensitic transformations in iron-base and in titanium-base alloys. A method is suggested for estimating M_s vs. composition curves for titanium and zirconium-base systems where such data are presently unavailable. (auth)

2989 NP-7047

Brush Beryllium Co., Cleveland.

PRODUCTION OF BERYLLIUM SHEETS FINISHED FLAT TO GAUGE. PHASE II. Progress Report No. 2 [for] February 1, 1958 to April 30, 1958. K. G. Wikle and G. M. Glenn. 42p. Contract AF-33(600)-35829.

An evaluation made of the rolling characteristics and the physical properties in sheet form of various types of sintered beryllium and a beryllium casting are described. The relation of grain size, BeO content, and basal-plane orientation to tensile properties is shown. A discussion of the effect of such rolling variables as reduction per pass and unidirectional and bidirectional reduction ratios on properties and rolling success is given. A study of pack-rolling technique, including cladding materials, parting compounds, and pack design, is described. Bare-rolling experiments, straightening technique, and characteristics of the first sheet delivered on this project are discussed. (auth)

2990 NP-7053

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

SELECTED ACCESSIONS. Nov. 15, 1958. 17p.

A listing of selected, acquired articles, reports, and papers concerning titanium, beryllium, refractory metals, and steels is presented. In addition, a listing of 12 miscellaneous reports related to welding and fabrication methods for high-temperature materials is included. (J.R.D.)

2991 NP-7075

American Electro Metal Corp., Yonkers, N. Y.

BORIDES AS TOOL MATERIALS. Final Report [for] April 1, 1951 to December 31, 1953. Oct. 1, 1954. 88p. Contract Nonr-295(02).

The purpose of this research was to find a cutting tool material prepared from metallic borides which would be able to substitute for the presently used WC–Co or WC–TiC–Co compositions. This research resulted in the final selection of three materials all of which contained the ternary boride compound Mo_2NiB_2. The difference between these three materials is essentially in the nature and amount of the binder which is formed as a eutectic either between two borides or between a boride and a metal. The starting compositions for these three materials are: 90% Mo_2B + 10% Ni, 50% Mo_2NiB_2 + 50% Mo_2B, and 90% Mo_2NiB_2 + 5.5% CrB + 4.5% Ni. (W.L.H.)

2992 NYO-2160

Massachusetts Inst. of Tech., Cambridge.

INVESTIGATION OF PHENOMENA RELATED TO LIQUID METAL CORROSION. Period Covered: October 1, 1957 to July 1, 1958. David A. Stevenson and John Wulff. Aug. 5, 1958. 13p. Contract AT(30-1)-2081. $3.30(ph OTS); $2.40(mf OTS).

The solubilities of Ni in Ag, Co in Pb, Cr in Sn, and Fe in Pb were determined. Data on the rate of solution of Cu in Pb and Ni in Pb at different temperatures were also obtained. (auth)

2993 ORNL-2544

Oak Ridge National Lab., Tenn.

CORRELATION OF CAVITATION INCEPTION DATA FOR A CENTRIFUGAL PUMP OPERATING IN WATER AND IN SODIUM POTASSIUM ALLOY (NaK). A. G. Grindell. Dec. 11, 1958. 41p. Contract W-7405-eng-26. $1.50(OTS).

For the centrifugal pump under investigation, the static head at pump suction, in feet absolute, at cavitation inception was correlated for water and for 1500°F NaK on the basis of the differences of the vapor pressures of the two liquids. The difference between the vapor pressure of water and NaK, for the same conditions of pump speed and liquid flow, was added to the water-test cavitation inception value, and this estimate proved to be a good approximation to the experimental value found for cavitation inception with NaK. (auth)

2994 ORNL-2635

Oak Ridge National Lab., Tenn.

DEFORMATION TEXTURES IN URANIUM–ALUMINUM ALLOYS (thesis). William Clarence Thurber. Nov. 20, 1958. 64p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

Submitted to the Univ. of Tenn.

The deformation textures were determined for U–Al alloys containing up to 13 wt. % U and fabricated by both extrusion and cold rolling. The sheet textures of Al, a 5 wt. % U–Al alloy, and a 13 wt. % U–Al alloy were determined for alloys which were reduced 90% in thickness by cold rolling. The fiber texture of a 13 wt. % U–Al alloy that was extruded at 455°C with a 90% reduction in area was also determined. The most preferred orientations for the cold-rolled Al and the cold-rolled 5 wt. % U–Al alloy were found to be near $(113)\langle\bar{3}\bar{4}3\rangle$ and $(124)\langle\bar{2}\bar{3}2\rangle$, respectively. The ideal texture for the cold-rolled 13 wt. % U–Al alloy was found to be near <111> fiber texture. In the 13 wt. % U–Al alloy, extruded at 455°C, a <111> fiber texture was observed. (W.L.H.)

2995 RDB(C)TN-124

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

THE EFFECT OF CHLORIDE ON THE CORROSION OF AUSTENITIC STEEL IN NITRIC ACID. T. E. Evans and P. A. Hayes. 1958. Date of MS. Apr. 7, 1955. 9p.

A laboratory study of the influence of chlorides at concentrations likely to be present in ores for processing at Springfields on the rate of corrosion of austenitic steel plant material in nitric acid media has been undertaken. It has been shown that chlorides increase the rate of corrosion in the vapor phase but not significantly in the liquid phase. Attack in the vapor phase is thought to be due to the corrosive action of condensed vapor which may contain a higher concentration of chlo-

ride than the original solution because of the appreciable volatility of nitrosyl chloride formed by the action of nitric acid on chlorides. The nature of the corrosion is governed by the experimental conditions; localized pitting occurs if the condensate is allowed to accumulate on a small area of metal, otherwise the attack is of a more general nature. Under plant conditions the former type of attack is potentially the more dangerous. (auth)

2996 WADC-TR-57-242(Pt. II)
Crucible Steel Co. of America, Pittsburgh.
INVESTIGATION OF Fe–Mn–Cr–N–C SYSTEM FOR HEAT RESISTANCE AND OXIDATION RESISTANCE BETWEEN 1200 F AND 2000 F. Period covered: April 1, 1957 to March 31, 1958. J. P. Tarwater and E. J. Dulis. Sept. 15, 1958. 114p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOY. Contract AF33(616)-3318. (AD-203523).

Austenitic Cr–Mn–C–N steels containing various combinations of V, Nb, W, and/or Mo had, after heat treating, room- and elevated-temperature tensile properties and creep-rupture strengths that compared favorably with those of such superalloys as A286 and Inco 901. Proper selection of composition and heat-treatment enabled development of adequate ductility in tension and creep rupture although a marked decrease in impact properties could not be avoided. Calcium additions improved the creep rupture strength of Cr–Mn–C–N steels that did not contain additions of strengthening elements (V, Nb, Mo, and W). A silicon addition of about 2% to high-chromium Cr–Mn–C–N steels increased the oxidation resistance at 2000 and 2200°F so that these steels compared favorably with Type 310 stainless steel. Both strengthened and unstrengthened austenitic Cr–Mn–C–N steels could be hot-rolled to sheets without the formation of edge cracks or surface defects, but rolling pressures higher than those for Type 310 stainless steel were required. (auth)

2997 WADC-TR-58-13(Pt.I)
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
HIGH-TEMPERATURE INSULATION FOR WIRE. Period Covered: February 1, 1957 to January 31, 1958. J. D. Walton and J. N. Harris. Jan. 31, 1958. 35p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF-33(616)-3944. (AD-151062).

A literature survey was undertaken to review possible methods for use in developing an electrical insulating coating for the high temperature protection of wire. Ceramic-organic coatings were developed which cover the range from room temperature to 1300°F when applied directly to metal. These coatings withstand 1500°F, but a wetting problem was encountered with the enamel on metals. However, since the final ceramic organic coating is applied over a base coating of aluminum oxide the wetting problem is not expected to cause difficulty. The effect of solution of aluminum oxide in the enamel is being investigated. Curing studies have shown that methods of curing resin-frit coatings is an important parameter in obtaining proper burn-out temperature of resins. Aluminum phosphate and silica were tested briefly as possible base coatings for the final ceramic-organic coating but adherence and corrosion problems caused this work to be discontinued. Several anodizing baths have been tried, among them boric acid, oxalic acid, and sulfuric acid. Among these, sulfuric acid seems to give the best anodized coating. Application of aluminum to copper wire has been the area where the most difficulty has been encountered. Although coatings with very good adherence have been obtained, first indications were that the problem in plating seemed to be in pre-cleaning of the copper. For this reason, gold plate was applied as an initial coating in some tests prior to aluminum plating the copper. (auth)

2998 WADC-TR-58-108(Pt.I)
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
THE EFFECT OF CADMIUM PLATING ON SAE 4340 STEEL IN THE PRESENCE OF STRESS CONCENTRATIONS AT ELEVATED TEMPERATURES. [Period covered]: March 1, 1957 to July 1, 1957. E. M. Kennedy, Jr. Dec. 1957. 40p. Project Title: METALLIC MATERIALS. Task Title: LOW ALLOY AIRCRAFT STEELS. (AD-151075; PB-131814). $1.25 (OTS).

An investigation was carried out to determine the effect of cadmium plating on the tensile and stress rupture properties of high strength steel at elevated temperatures. Tests were conducted on SAE 4340 steel, and properties of this material were investigated in the annealed and heat treated conditions. The annealed material was investigated at 600 and 611°F, effects on properties of the heat treated material were investigated at 500, 600, and 611°F. The properties of cadmium plated steel in both conditions, annealed and heat treated, were compared with the properties of unplated steel subjected to the same test conditions. (auth)

2999 WADC-TR-58-128
Crane Co., Chicago.
HEAT TREATMENT RESPONSE, MECHANICAL PROPERTIES AND STABILITY OF TITANIUM SHEET ALLOYS. Period Covered: June 1, 1956 to December 31, 1957. E. A. Sticha and F. W. Richards. Dec. 31, 1957. 120p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF-33(616)-3586. (AD-155851).

Tensile and bend test data indicate that the three titanium sheet alloys studied in this investigation have formability, when solution treated and quenched from an intermediate temperature in the alpha-beta phase field, equal to or better than annealed materials of these same compositions. Formability is not likely to be improved by heating to moderate temperature but less power would be required for forming. Best ductility is exhibited by the alloys of low interstitial content. Compositions with the greatest total alloy content give the highest strength and lowest ductility. It is possible to obtain high strength with satisfactory ductility by application of a solution treat, quench and age type of heat treatment to these alloys. The heat treatment for optimum properties varies with the interstitial content and, possibly, with nature of the interstitial elements. However, the interstitial elements seem to contribute to strength properties without detracting from ductility in the heat treated alloys. The solution temperature for maximum strength with satisfactory ductility is sometimes the same as that for maximum formability. Strain influences response to the subsequent aging treatment and results in properties which suggest overaging. Short-time strength decreases with increasing temperature and, somewhat anomalously, so do

ductility values. The effect of interstitial elements persists at high temperatures. The materials exhibit rather good creep resistance at 800°F with Ti: 6 Al: 4 V alloy having the highest strength and the Ti: 4 Al complex alloy the lowest. This is the same order of strength as determined by elevated temperature tensile testing. Exposure at 800°F may produce some embrittlement in the Ti: 6 Al: 4 V alloys and the high interstitial Ti: 4 Al complex alloy but the results are not conclusive. (auth)

3000 WADC-TR-58-152

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDY OF THE MECHANISM OF FAILURE OF ROCKET MATERIALS. Period Covered: February 1, 1957 to January 31, 1958. Yehuda Baskin and Thomas A. Greening. Apr. 4, 1958. 94p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF-33(616)-3925. (AD-155804).

Twenty-five different materials were evaluated as nozzle inserts in rocket motors utilizing typical solid propellants. Evaluation of each material consisted of its exposure to the high-temperature sonic gas flow of solid propellant engines under conditions of high internal chamber pressure for relatively short periods. Some of the nozzle materials were incorporated in subsequent trials at various combinations of chamber pressure and duration. Unfired and fired nozzles were examined, utilizing x-ray-diffraction, microscopic, chemical, metallographic, and other analytical techniques. Chemical changes taking place in the nozzle as a consequence of firing are described. The mechanisms considered responsible for deterioration of the various materials are discussed in detail. (auth)

3001 WADC-TR-58-204

Michigan. Univ., Ann Arbor. Engineering Research Inst.

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND CREEP-RUPTURE PROPERTIES OF HEAT-RESISTANT ALLOYS. Period covered: December 1956 to March 1958. A. Phillip Coldren and James W. Freeman. June 23, 1958. 71p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3239. (AD-155711).

Progress is reported for an investigation of the influence of conditions of hot working on the properties of alloys at high temperatures. Conditions of working can be used to control microstructural variations in a manner which cannot be obtained in any other procedure and is capable of developing structures superior in properties to any other treatment. The major objective is to define the basic principles involved so that they can be applied to the general problem of developing optimum properties in any alloy. The relatively simple structure of "A" Nickel is being used as an experimental material for study of the role of working for properties in the as-worked condition. A-286 alloy is being used as an example of a material whose properties are influenced after solution and aging treatments by the conditions of prior working. The results reported cover the initial surveys of the relationships of working conditions to creep and rupture properties. Structural analyses to define the basic principles involved were confined to preliminary partial studies. The investigation is being continued with emphasis on the structural studies. (auth)

3002 WADC-TR-58-230

Arkansas. Univ., Fayetteville.

METHODS OF DETERMINING SURFACE ROUGHNESS. M. K. Testerman. June 1958. 48p. Project title: SURFACE AND INTERFACE PHENOMENA OF MATTER. Task title: RESEARCH IN PHYSICAL PROPERTIES OF FILMS. Contract AF33(616)-2865. (AD-155828).

Twelve techniques for investigating the microscopic surface roughness of continuous surfaces are cited as background. (WADC TR 56-233 is a critique of known methods for measuring surface roughness.) Of these the method of capacitance measurements was chosen for experimental investigation. Measurements of permanent capacitance were made upon specimens coated with monomolecular films and were found not to be reproducible. Measurements of polarization capacitance made in aqueous electrolyte solutions were reproducible. Two methods of measuring polarization capacitance were tested, namely, the charging curve method, and the bridge method. Consistent surface roughness factors were obtained by the bridge method for copper, nickel, and steel surfaces. Investigations with formamide and acetonitrile revealed that these non-aqueous solvents were not satisfactory for polarization capacitance measurements. Experimentation was begun to establish a radioactive method for measuring surface roughness. Results were obtained that indicate this method to be better for aluminum surfaces than is the polarization capacitance method. (auth)

3003 WAL-TR-893.3/2

Watertown Arsenal Lab., Mass.

ELASTIC STRESSES IN A SANDWICH-TYPE BULKHEAD. J. F. Mescall. Sept. 1958. Revised Nov. 1958. 47p. Project title: ABMA—STRESS ANALYSIS STUDIES FOR THE "JUPITER" PROJECT.

The theory of small deformations of sandwich-type shells was applied to a spherical sandwich segment and a toroidal sandwich segment. Solutions for the resulting systems of equations were obtained separately, and suitably joined by imposing conditions of continuity. As an illustrative example, numerical results for the surface stress distribution were obtained for a representative set of data. (auth)

3004 WAPD-PMM-79

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

ALUMINUM ALLOYS SUITABLE FOR USE IN HIGH TEMPERATURE WATER. Report No. 2. J. Belle. Oct. 10, 1955. 11p. $3.30(ph OTS); $2.40(mf OTS).

Corrosion tests were performed on some aluminum alloys in high-temperature water. Results of the tests are reported. (W.L.H.)

3005 WAPD-PWR-PMM-1879

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] ALTERNATE CONTROL ROD MATERIALS; SILVER-BASE ALTERNATE CONTROL ROD ALLOYS. [Apr. 1958]. 21p. $4.80(ph OTS); $2.70(mf OTS).

The creep properties of Ag-base alloys and specifically of the Ag−15% In−5% Cd wrought alloy are presented. (W.L.H.)

3006 YAEC-67

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

STUDIES OF THE CORROSION OF AISI 304 STAINLESS STEEL AND AISI 4135 CARBON STEEL EXPOSED TO SATURATED SOLUTIONS OF BORIC ACID. C. R.

Bergen—D. D. Whyte, ed. Nov. 1958. 18p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

AISI 304 stainless steel and AISI 4135 carbon steel specimens were exposed to five wt. % (70°F) and thirteen wt. % (140°F) boric acid solutions. These are essentially saturation concentrations. After four weeks exposure it was found that the AISI 304 stainless steel was not attacked under these conditions but that the carbon steel had developed considerable corrosion products in the form of scale. It was found that the attack on carbon steel at 70°F in a five wt. % boric acid solution was greatly reduced by the addition of sufficient base to neutralize the solution. A thirteen wt. % boric acid solution badly attacked the carbon steel at 140°F even when adjusted to neutral pH conditions. (auth)

3007 AEC-tr-3465

CREEP OF AUSTENITIC STEEL UNDER COMPLEX STRESS. I. A. Oding and G. A. Tulyakov. Translated by Oak Ridge National Lab. Library Staff from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 1, 3-10 (1958). 11p.

The results of experiments on the creep in the complex stress state of austenitic steel at 600°C are presented. The experiments were performed using an apparatus in which thin-walled tubular samples were subjected to the effect of varying certain constants in the value of the tensile force and torsion moment. Experimental conditions are described, and a discussion of the results is presented. In addition, several conclusions are listed. (J.R.D.)

3008 AEC-tr-3486

METALS AND ALLOYS. XVIII. LATTICE STRUCTURE OF LiAl. E. Zintl and G. Woltersdorf. Translated by K. S. Bevis (Savannah River Lab.) from Z. Elektrochem. 41, 876-9(1935). 9p.

Lithium–aluminum alloys were investigated by x-ray analysis. The intermediate LiAl phase was found in the 0 to 50 at. % Li region. The lattice dimensions of aluminum saturated with Li were less than expected, considering the additivity of the atomic radii. Consideration of lattice constants and of elements which produce NaTl structures with Li or Na, in which the noble atoms form a diamond lattice, leads to an idea of the reciprocal action of the atoms in such structures and a working hypothesis for further investigations. (J.R.D.)

3009

FABRICATION, PROPERTIES, AND USE OF FRITTED MECHANICAL PIECES. Raymond Hauser. Age nucléaire No. 7, 48-54(1957) Nov.-Dec. (In French)

A brief survey is presented of the fabrication, properties, and use of fritted mechanical pieces. The future development of powder metallurgy is considered. (J.S.R.)

3010

THE PRODUCTION AND CONSUMPTION OF THORIUM. G. E. Kaplan, Yu. I. Zarembo, and T. A. Uspenskaya. Atomnaya Energ. 5, 147-54(1958). (In Russian)

A review is given of the production methods and consumption of thorium. (R.V.J.)

3011

METALLIC THORIUM. G. A. Meerson and A. F. Islankina. Atomnaya Energ. 5, 155-65(1958). (In Russian)

A short review is presented on thorium metallurgy. Soviet investigations in thorium powder metallurgy are described. The physico-chemical properties and electrolytic and calciothermal compression characteristics of thorium powder are discussed. A theoretical review is given of the basic factors in sintering processes and the relation between the changes in durability and plasticity of thorium compacts made from electrolytic and calciothermal powders, and the temperature and holding time are shown graphically. Cakes of calciothermal powder on calcination at 1150 to 1200°C change their shape due to the intensive calcium evaporation. To obtain dense metal from calciothermic powder, the cakes must be subjected to secondary or calibrated compression at low temperature, followed by annealing. Finally, the data on physical and mechanical properties of thorium produced from electrolytic and calciothermal powder are described. Electrolytic thorium is more plastic (δ = 35 to 43%) and less stable ($\delta_b \sim 16.5$ kg/mm^2) than calciothermal thorium (δ = 17 to 23% and δ_b = 22 kg/mm^2). (tr-auth)

3012

HEATS OF FORMATION OF UAl_2, UAl_3, AND UAl_4. M. I. Ivanov, V. A. Tumbakov, and N. S. Podolskaya. Atomnaya Energ. 5, 166-70(1958). (In Russian)

The intermetallic compounds UAl_2, UAl_3, and UAl_4 were prepared by interdiffusion of heated aluminum and dispersed uranium, obtained by disintegration of hydride, followed by crushing and repeated heating of the powder. The x-ray-diffraction analysis showed a single-phase structure. Judging by the expelled hydrogen in the dissolution of the preparations and the initial components of specially selected solvent (mixture of HCl, H_3PO_4, Na_2SiF_6, H_2PtCl_6, and $CuSO_4 \cdot 5\,H_2O$), it was found that the composition of preparations was $UAl_{1.997}$, $UAl_{2.994}$, and $UAl_{3.997}$. The heats of formation ($-\Delta H^\circ_{298}$) of UAl_2, UAl_3, and UAl_4 are 22.3 ± 2.4, 25.2 ± 2.2, and 31.2 ± 3.1 kcal/mole, respectively. (tr-auth)

3013

PREPARATION OF U_3O_8 CRYSTALS AND INVESTIGATIONS OF THEIR STRUCTURE. B. Khodura, G. Landsperskii, V. Makhachek, and Ya. Maly. Atomnaya Energ. 5, 181-3(1958). (In Russian)

Effects of the original uranium composition, conditions of precipitation temperature, and thermal disintegration time on the dimensions and composition of U_3O_8 are studied. Microstructures and diffraction patterns of U_3O_8 prepared from ammonium diuranate, uranyl nitrate, and uranium peroxide calcinated at 1100°C are presented. (R.V.J.)

3014

REACTIONS OF Pu WITH OTHER METALS, AS RELATED TO THEIR POSITIONS IN THE PERIODIC TABLE BY D. I. MENDELEEV. A. A. Bochvar, S. T. Konobeevskii, et al. Atomnaya Energ. 5, 303-9(1958). (In Russian)

A report is presented on the regularities found in plutonium interactions with various metals as related to their position in the periodic table. A table of crystal structures of some binary compounds and phase diagrams for Pu alloyed with Al, Be, Bi, Co, Cr, Fe, Mo, Os, Pb, Th, U, and Zr are included. (R.V.J.)

3015

URANIUM–MOLYBDENUM ALLOYS IN REACTOR DESIGN. V. V. Kalashnikov, V. V. Titova, G. Ya. Sergeev, and A. G. Samoilov. Atomnaya Energ. 5, 421-31 (1958). Oct. (In Russian)

A review is given on the properties of uranium–

molybdenum alloys and their applications as fuel elements in heterogeneous nuclear reactors. (R.V.J.)

3016

MATERIALS OF CONSTRUCTION. HIGH-TEMPERATURE METALS. E. Skinner (International Nickel Co., New York). Chem. Eng. 65, No. 25, 137-47(1958) Dec. 15.

Some principles of metal selection for high-temperature service are discussed. Alloys are listed covering a wide spectrum of composition from mild steel and low-alloy cast iron, through the low-alloy steels, stainless steels, chromium–ferritic and the chromium–nickel austenitic types, to nickel base heat-resistant alloys and ultimately pure nickel. Information on the behavior of different alloys at high temperatures, 400 to 2000°F, is presented. (J.H.M.)

3017

THE STRUCTURAL HARDENING OF ALUMINUM–NICKEL ALLOYS. Henry Martinod and Jean Calvet. Compt. rend. 247, 1462-4(1958) Nov. 3. (In French)

Hardness studies of the development of tempered binary Al–Ni alloys, maintained for a long period in an isothermal state, show that hardening is a very slow phenomenon and that the alloy keeps the same general aspect over a large temperature range. Iron, one of the supplementary additions tested, has a very great inhibitory effect even at low concentrations. (tr-auth)

3018

STUDY OF THE ELECTRICAL RESISTANCE OF THE CERIUM–HYDROGEN SYSTEM. Joseph-N. Daou. Compt. rend. 247, 1595-7(1958) Nov. 10. (In French)

The electrical resistance of the cerium–hydrogen system was studied as a function of the hydrogen content. The hydration was made at 500°C by successive small additions of hydrogen, the metal having been maintained under vacuum at temperatures of approximately 500°C for at least 48 hr. Each addition of hydrogen made a variation in the composition of 0.2 atoms H/atom Ce. The variations of the ratio R/R_0 are graphed. There is a decrease of the electrical resistance reaching 30% for compositions approaching $CeH_{1.8}$; at CeH_2 there is an abrupt increase of the resistance. Between $CeH_{0.2}$ and $CeH_{1.7}$, the variation of R/R_0 is linear. When the hydrated samples are heat treated, an anomaly of resistivity appears in the region of CeH. (J.S.R.)

3019

CRYSTALLOGRAPHIC STUDY OF THE CERIUM–HYDROGEN SYSTEM. Claude Ayphassorho. Compt. rend. 247, 1597-9(1958) Nov. 10. (In French)

During experimentation to prepare the hydride of the structure CeH_2 by desorption of samples previously saturated with hydrogen, a new phase was noticed. The sample, with composition $CeH_{2.4}$ was heated to 300°C. A progressive desorption of hydrogen occurred. When the composition of the sample was approximately CeH_2, the temperature was increased to 500°C to maintain the desorption. At 500°C a sharp desorption was observed leading to the composition $CeH_{0.7}$. A c-f-c structure was obtained with $a = 5.04 \pm 0.01$ A. Studies showed that this phase was caused by the strong predominance of hydrogen in the octahedral sites. (J.S.R.)

3020

THE INSOLUBILITY OF OXYGEN IN ZONE-MELTED α IRON. Raymond Sifferlen. Compt. rend. 247, 1608-11 (1958) Nov. 10. (In French)

The solubility curves of oxygen in iron of different purity were determined as a function of the oxidation temperature. It was shown the solubility of oxygen in zone-melted iron remained almost zero at all temperatures up to 900°C. In iron of less purity, the oxygen solubility varied with the temperature. The heats of activation were calculated for the electrolytic iron annealed at 880 and 1200°C and which was used in the experiments. The results obtained lead to the conclusion that the oxygen absorption could be attributed to a preferential solubility in the grain joints of the metal. (J.S.R.)

3021

THE EFFECT OF IRON PURITY ON ITS FRAGILITY AT LOW TEMPERATURES. Simone Besnard and Jean Talbot. Compt. rend. 247, 1612-13(1958) Nov. 10. (In French)

At the temperature of liquid nitrogen, the stress curves of iron with different degrees of impurities were measured. The samples showed no plastic deformation if they had been previously annealed below a certain critical temperature whose value depends on the purity of the iron. (tr-auth)

3022

CRYSTALLINE STRUCTURE AND CHEMICAL COMPOSITION OF DENDRITE PRECIPITATES FORMED IN ALLOYED BRASS RICH IN ZINC. Adrienne R. Weill, Jacques Descamps, and Pierre A. Jacquet. Compt. rend. 247, 1729-31(1958) Nov. 17. (In French)

Two grades of complex brass with β matrix were studied by micrography, x-ray diffraction, and microanalysis by electron probe. In one of the brass samples, the precipitates are homogeneous and there is a Fe–Mn–Al solid solution. In the other sample, the precipitates are formed from the same phase with the core and its branches of an ordered Ni–Fe–Al solid solution. (tr-auth)

3023

ELECTRON MICROSCOPIC STUDY OF THE PRECIPITATION OF Al–Zn–Mg ALLOY WITH 9% Zn AND 1% Mg (AZ9G1). Bernard Genty, René Graf, and Gabriel Lenoir. Compt. rend. 247, 1731-4(1958) Nov. 17. (In French)

The examination of thin samples by electron bombardment shows that between 100 and 150° the precipitates are small platelets orientated along the (111) plane. Above 150° the precipitates are platelets of the same orientation or elongated bands in the (110) direction. (tr-auth)

3024

STUDY OF THE $\alpha \rightleftharpoons \beta$ ALLOTROPIC TRANSFORMATION OF ZIRCONIUM. Jean-Paul Langeron and Pierre Lehr. Compt. rend. 247, 1734-7(1958) Nov. 17. (In French)

The characteristics of the allotropic transformation of zirconium, relations of crystallographic orientation, and the effect of superficial relief provoked by the shearing mechanism are studied. The transformation involves a process of diffusion of the impurities. The precipitation of iron during the course of transformation is analyzed. (tr-auth)

3025

LAWS OF FORMATION OF METASTABLE PHASE IN TITANIUM ALLOYS. Yu. A. Bagaryatskii, G. I. Nosova, and T. V. Tagunova (Central Research Inst. of Ferrous Metallurgy). Doklady Akad. Nauk S.S.S.R. 122, 593-6(1958) Oct. 1. (In Russian)

X-ray diffraction in titanium-base binary alloys with

Mo, Nb, Re, Ta, V, and W, in which β-phase annealing at high temperature forms metastable phases α', α'', ω, and β, is studied in order to determine the hardness of alloys in relation to the content of the alloying second element. (R.V.J.)

3026

ON THE DISCONTINUITY IN DURALUMIN FATIGUE CURVES. V. I. Shabalin. Doklady Akad. Nauk S.S.S.R. 122, 600-2(1958) Oct. 1. (In Russian)

The fatigue stability of plated duralumin 2.5 mm in thickness was tested on specially constructed 1½ ton eccentric pulsators designed for testing specimens at repeated expansion with frequencies of 10 cycles per minute. Mechanical characteristics of the specimens are: the maximum stability of rupture 45.95 kg/mm^2, nominal maximum yield 33.37 kg/mm^2, and relative elongation 17.86%. Fatigue tests of 186 specimens after removing the plating layer indicated the fatigue curve discontinuity at 32 to 33 kg/mm^2. (R.V.J.)

3027

GERMANIUM ELECTRODE WITH p–n STRUCTURE. E. A. Efimov and I. G. Erusalimchik. Doklady Akad. Nauk S.S.S.R. 122, 632-4(1958) Oct. 1. (In Russian)

In previous works it was shown that the process of germanium anode solubility depends on the concentration of holes on the semiconductor surface. In relation to this studies were made of the germanium electrode behavior with the p–n transition, by means of which it is possible to inject holes and form depleted areas. Polarization curves for Ge electrode with p–n transition are shown. (R.V.J.)

3028

ON THE ATOMIC STRUCTURE OF SOLID SOLUTIONS OF CHROMIUM IN NICKEL. Yu. A. Bagaryatskii and Yu. D. Tyapkin (Central Research Inst. of Ferrous Metallurgy). Doklady Akad. Nauk S.S.S.R. 122, 806-9 (1958) Oct. 11. (In Russian)

Phase and x-ray-diffraction studies show that submicroscopic areas with a well-regulated rhombic structure (Ni_2Cr), with several possible orientations to the initial solid solution are formed during Ni–Cr (28 and 35 at. % Cr) annealing. At high-temperature tempering (over 800°) the atomic structure is close to Ni_2Cr type. Consequently, the K state in Ni–Cr must be related to the formation of submicroscopic heterogeneity and Cr enriched areas up to Ni_2Cr, with mutual atomic distribution of the Pl_2Mo type. (R.V.J.)

3029

THE THERMODYNAMIC PROPERTIES OF Cu–Ni AND Fe–Co SOLID SOLUTIONS. Ya. I. Gerasimov, A. A. Vecher, and V. A. Geiderikh (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 122, 834-6 (1958) Oct. 11. (In Russian)

The free energy, heat, and entropy of Cu–Ni alloy formation and iron activity in Fe–Co alloys were determined by the electromotive force method. The electromotive forces of Cu–Ni alloys were measured in a galvanic element. The alloy was prepared from copper and nickel powder and annealed for 100 hours at 1050 to 1250°C. The experiment was made in an argon atmosphere at 620 to 750°C. It is shown that electromotive forces increase with temperature, not linearly but much faster. With the temperature increase positive deflections decrease rapidly; the heat and entropy of the Cu–Ni alloy formation depend on temperature. Measurements of Fe–Co electromotive forces were made. The values of iron activity in the Fe–Co alloy agree with the data obtained by the equilibrium constant method. (R.V.J.)

3030

EFFECTS OF HYDROGEN ON THE STRUCTURE AND PROPERTIES OF INDUSTRIAL TYPE TITANIUM ALLOYS. S. G. Glazunov, I. I. Kornilov, and A. M. Yakimova. Izvest. Akad. Nauk. S.S.S.R. Otdel. Tekh. Nauk. No. 9, 17-24(1958) Sept. (In Russian)

Effects of various compositions of hydrogen on the structure and properties of Al–Cr–Ti and Al–Cr–Mo–Ti alloys with $\alpha + \beta$ structure and the optimum conditions for the vacuum annealing of Al–Cr–Ti alloy without the interference of injurious effects of hydrogen are investigated. (tr-auth)

3031

EFFECTS OF ELASTIC SUPERSONIC VIBRATION ON THE DEGASSING PROCESSES IN ALUMINUM ALLOYS. M. B. Al'tman, D. V. Vinogradova, V. I. Slotin, and G. I. Eskin. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk. No. 9, 25-30(1958) Sept. (In Russian)

Effects of elastic 20-hertz vibration on the hydrogen segregation process in Al–Cu–Mg–Si system (2% Cu, 0.8% Mg, 2.5% Si, 1.0% Ni, 1.0% Fe, 0.1% Ti, with Al base) were investigated. (R.V.J.)

3032

CONSTITUTION DIAGRAMS AND HEAT RESISTANCE AT CORRESPONDING TEMPERATURES. M. V. Zakharov and L. I. Karpenko. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 9, 31-6(1958) Sept. (In Russian)

Constitution diagram data and heat resistance were plotted at corresponding temperatures for some binary and ternary copper alloys (Cu–Zn, Cu–Al, Cu–Sn, Cu–Sb, Cu–Cr, Cu–Zr, and 20 alloys of quasi-binary systems of Cu–Ni_2Si and Cu–NiAl). (R.V.J.)

3033

PHASE EQUILIBRIA IN THE ALKALI FLUORIDE–URANIUM TETRAFLUORIDE FUSED SALT SYSTEMS. II. THE SYSTEMS KF–UF_4 AND RbF–UF_4. R. E. Thoma, Herbert Insley, B. S. Landau, H. A. Friedman, and W. R. Grimes (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc. 41, 538-44(1958) Dec.

Detailed phase diagrams are presented for the binary systems KF–UF_4 and RbF–UF_4. Data for the determination of phase boundaries were obtained in large part by quenching after equilibration. Thermal analysis and visual observation were used as supplementary methods. Phase identifications were made by x-ray-powder diffraction and by optical microscopy. In the system KF–UF_4 four compounds have been identified. Two of these, $3KF \cdot UF_4$ and $7KF \cdot 6UF_4$, melt congruently at 957°C. and at 789°C., respectively. The compound $2KF \cdot UF_4$ melts incongruently to $3KF \cdot UF_4$ and liquid at 755°C., and the compound $KF \cdot 2UF_4$ melts incongruently to UF_4 and liquid at 765°C. There are three eutectic points in the system: 15.0 mole % UF_4, 735°C.; 38.5 mole % UF_4, 740°C.; and 54.5 mole % UF_4, 735°C. The compound $2KF \cdot UF_4$ decomposes during cooling to $3KF \cdot UF_4$ and $7KF \cdot 6UF_4$ at 608°C. Two other compounds, $KF \cdot 3UF_4$ and $KF \cdot 6UF_4$, have been described by another investigator. One of these, $KF \cdot 3UF_4$, was not obtained at all in the present investigation. The other, $KF \cdot 6UF_4$, was not obtained under equilibrium conditions and was found only in KF-UF_4 mixtures that had been exposed to the atmosphere while molten. Seven solid compounds are present in the system RbF–UF_4. All of these melt incongruently with the exception of $3RbF \cdot UF_4$ and

$RbF \cdot UF_4$, which melt at 995°C. and at 735°C., respectively. The incongruently melting compounds and their melting points, peritectic compositions, and melting products are: $2RbF \cdot UF_4$, 818°C., 38 mole % UF_4, $3RbF \cdot UF_4$ + liquid; $7RbF \cdot 6UF_4$, 693°C., 44 mole % UF_4, $RbF \cdot UF_4$ + liquid; $2RbF \cdot 3UF_4$, 722°C., 56.5 mole % UF_4, $RbF \cdot 3UF_4$ + liquid; $RbF \cdot 3UF_4$, 730°C., 57 mole % UF_4, $RbF \cdot 6UF_4$ + liquid; and $RbF \cdot 6UF_4$, 832°C., 70.5 mole % UF_4, UF_4 + liquid. The three eutectic temperatures and compositions in the system are: 10.0 mole % UF_4, 710°C.; 43.5 mole % UF_4, 675°C.; and 55.0 mole % UF_4, 714°C. (auth)

3034

THE PSEUDO–BINARY SYSTEMS OF URANIUM CARBIDE WITH ZIRCONIUM CARBIDE, TANTALUM CARBIDE, AND NIOBIUM CARBIDE. L. D. Brownlee (Metropolitan-Vickers Electrical Co., Manchester, Eng.). J. Inst. Metals 87, 58-61(1958) Oct.

The three pseudo-binary systems of uranium carbide with zirconium carbide, tantalum carbide, and niobium carbide respectively were examined. Methods that were developed for handling the highly pyrophoric uranium carbide powder are described. The melting-point/molecular-composition curves were determined for each system and found to be smooth curves. X-ray analysis shows that a complete range of solid solutions exists in each system and that the lattice-spacing/molecular-composition curves obey Vegard's law very closely. (auth)

3035

THE MOLYBDENUM–RHENIUM SYSTEM. A. G. Knapton (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). J. Inst. Metals 87, 62-4(1958). Oct.

X-ray, metallographic, and melting-point studies were made of the molybdenum-rhenium system. Rhenium dissolves extensively in molybdenum, the maximum solubility of 43 at. % at 2440°C falling to 26 at. % at 900°C. The solid solubility of molybdenum in rhenium is 15 at. % at 2500°C and 8 at. % at 900°C. Two intermediate phases occur in the system. The σ phase has a wide homogeneity range, 52 to 71 at. % rhenium at 2400°C, and forms peritectically from rhenium solid solution and liquid at 72 at. % rhenium, 2520°C. The χ phase, with the α-manganese structure, forms peritectoidally at 1800° to 1850°C, 76.5 at. % rhenium, and exists from 76 to 80 at. % rhenium at 1200°C. (auth)

3036

PRELIMINARY INVESTIGATIONS ON THE PROPERTIES OF CHROMIUM AND CHROMIUM ALLOYS AT ELEVATED TEMPERATURES. G. R. Wilms and T. W. Rea (Australian Defence Scientific Service, Melbourne). J. Inst. Metals 87, 77-8(1958) Nov.

The high-temperature properties of chromium, and of chromium–10% tungsten and chromium–5% molybdenum alloys, have been assessed by tensile creep tests in air at 950°C. The alloys show considerable promise as high-temperature materials, on the basis of both strength and oxidation resistance. Structural changes associated with the creep deformation of chromium and the alloys are similar to those previously observed in other metals. Intercrystalline cavities develop during creep, leading to intercrystalline fractures, but certain differences have been observed between the cavities in the pure metal and those in the alloys. (auth)

3037

THE URANIUM–THORIUM SYSTEM AND SOME ASPECTS OF URANIUM–THORIUM–ZIRCONIUM SYSTEM. J. R. Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 87, 94-6(1958) Nov.

The uranium–thorium system has been investigated over the whole composition range. A simple eutectic system is formed, with a region of liquid immiscibility extending from 6 to 49 at. % thorium. The solubility of thorium in uranium is 0.30 at. % at 900°C and <0.05 at. % at 700°C. Solubility of uranium in thorium is also temperature-dependent, with limits of 0.15, 1.9, and 2.55 at. % at 800°, 1100°, and 1325°C, respectively. The effects of zirconium additions on the eutectic composition and temperature and on the occurrence of liquid immiscibility have also been studied.

3038

PROPERTIES OF TITANIUM–NIOBIUM ALLOYS. J. W. Suiter (Melbourne Univ.). J. Inst. Metals 87, 104-5(1958) Oct.

Titanium–niobium alloys containing 0, 5, 10, 20, 30, and 50 at. % niobium were examined. The mechanical properties of these alloys are presented graphically. The results show that a second phase (β solid solution) does not affect the strength of titanium alloys at temperatures above 500°C, although considerable strengthening may occur at lower temperatures. (J.R.D.)

3039

THE THORIUM–CERIUM SYSTEM. R. T. Weiner, W. E. Freeth, and G. V. Raynor (Birmingham Univ., Eng.). J. Inst. Metals 87, 106-7(1958) Oct.

An explanation and substantiation of a report of research on lattice spacing vs. composition of thorium–cerium alloys are presented. The initial sharp fall in the lattice spacing vs. composition curve up to about 1.4 at. % cerium is discussed, and it is pointed out that the spacing of thorium is not sufficiently understood to justify empirical calculations for pure thorium or in alloys containing a small quantity of cerium. In addition, it is felt unlikely that the sharp drop in lattice spacing on the initial addition of cerium to the thorium sample is due to the reaction of the solute with hydrogen present in the thorium. (J.R.D.)

3040

RADIOGRAPHY AND AUTORADIOGRAPHY OF PLUTONIUM. D. E. Elliott and G. H. Tenney. J. Soc. Non-Destructive Testing 16, 430-7(1958) Sept.–Oct.

The use of radiography and autoradiography as inspection methods for plutonium is discussed. Experiments made on three samples examined by these techniques are described. The effect of various object-to-film distances, the effect of lead front screens as radiation filters, radiographic exposure data for Pu, and radiographic sensitivity were considered in the radiographic inspection of Pu. (auth)

3041

HIGH-TEMPERATURE METALLURGY TODAY. L. P. Jahnke and R. G. Frank (General Electric Co., Cincinnati). Metal Progr. 74, No. 6, 86-91(1958) Dec.

Mechanisms for strengthening superalloys and refractory metal compositions for high-temperature service are discussed. Information is presented on: the performance of nickel, iron–nickel, and cobalt-base alloys under elevated temperature; the influence of heat treatment on 0.02% yield strength and 100-hr stress-rupture life of Rene 41 sheet alloy; the advantages and disadvantages of using tungsten, tantalum, molybdenum, columbium, and chromium at elevated temperatures; and the performance

of refractory alloys as compared with cast nickel-base alloys. (J.H.M.)

3042

HIGH-ALLOY CASTINGS, SPECIFICATIONS AND PROPERTIES. Ernest A. Schoefer (Alloy Casting Inst., Mineola, N. Y.). Metal Progr. 74, No. 6, 95-7(1958) Dec.

Information is presented on composition ranges, mechanical properties, corrosion resistance, and typical uses of corrosion and heat-resistant high-alloy castings. (J.H.M.)

3043

SELECTION OF ALLOYS FOR HEAT RESISTANT SERVICE. R. A. Miller (American Brake Shoe Co., Elyria, Ohio). Metal Progr. 74, No. 6, 98-101(1958) Dec.

Requirements for the selection of alloys for heat-resistance service are discussed. The following operating conditions are considered: the maximum temperature of operation of the cast; atmosphere in which the alloy is used; and service conditions such as continuous or semicontinuous with respect to temperature and atmosphere, discontinuous with respect to slow heating and cooling, rapid heating or cooling, and quenching. A discussion is also included on design considerations for heat-resisting alloys. (J.H.M.)

3044

SELECTION OF ALLOYS FOR CORROSION RESISTANT SERVICE. W. T. Bryan (Duriron Co., Dayton, Ohio). Metal. Progr. 74, No. 6, 102-5(1958) Dec.

Factors that should be considered in the selection of alloys for corrosion-resistant service are discussed. Characteristics of the corrosive environment, mechanical properties, and metallurgical structure are some of the factors that are considered. The discussions are limited mostly to the performance of iron–chromium, iron–chromium–nickel, and iron–chromium–molybdenum alloys in corrosion-resistant service. (J.H.M.)

3045

RESISTANCE WELDED TUBE JOINTS IN HEAT EXCHANGERS. J. J. Mueller (Martin Co., Baltimore). Metal Progr. 74, No. 6, 106-11(1958) Dec.

An automatic resistance welding process is discussed for producing tube joints in Inconel, stainless steel, and other nickel-base alloys. The resistance-welded tube joints are metallurgically sound, uniform, and capable of resisting severe thermal shock cycling. This process is also desirable because operator skill and endurance are not taxed. (J.H.M.)

3046

MICRO NONUNIFORMITY OF DEFORMATION OF METALS DURING HIGH TEMPERATURE HEATING. M. G. Lozinskiy, M. B. Guterman, and Ye I. Antipova. Metalloved. i Obrabotka Metal. No. 6, 6-9(1958).

The relations governing the kinetics of non-uniform deformation in micro volumes at temperatures above and below the equi-cohesion temperature, i.e., under conditions at which the grain boundaries are weaker or stronger than the body of the grain, were studied. The experiments were made with iron–molybdenum and nickel–molybdenum alloys. The equipment which was used permitted the direct microscopic observation of the surface of the alloy at temperatures up to 1100°C during deformation under stress in vacuum. The results showed that the magnitude of the deformation varies greatly within a single grain. (J.S.R.)

3047

THE TEMPERATURE DEPENDENCE OF THE HIGH-TEMPERATURE STRENGTH OF A SOLID SOLUTION. I. Ya. Dekhtyar. Sbornik Nauch. Rabot Inst. Metallofiz. Akad. Nauk No. 6, 85-91(1955). (Translated from Referat. Zhur. Met. No. 2, 1958, p. 270)

Based on the connection between diffusion phenomena and resistance to deformation at high temperatures, an examination was made of the relationship between the composition of a solid solution and its heat resistance. A formula is proposed for determining the composition of an alloy possessing its maximum strength at a given temperature. A numerical example is offered. (TCO)

3048

INVESTIGATION OF THE Nb–Mo SYSTEM. I. I. Kornilov and R. S. Polyakova. Trudy Inst. Met. Akad. Nauk No. 2, 149-53(1957). (Translated from Referat. Zhur. Met. No. 2, 1958, p. 233)

Specimens were prepared from powdered Nb (98.7%) and Mo (99.9%) by compacting briquettes and sintering or fusing them. From the data on thermal analysis (determination of the temperature of the solidus and recording of heating curves), a study was made of microstructure, microhardness, specific gravity, and electrical resistance and its temperature coefficient. A diagram of the fusibility of the Nb–Mo system was plotted showing crystallization of a continuous series of solid solutions with a flat minimum in the 20 to 30% Mo interval. (TCO)

3049

CRYSTAL STRUCTURE CHANGES IN AGING OF Cu–Ti ALLOY. E. G. Nesterenko and K. V. Chuistov (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR.). Ukrain. Fiz. Zhur. 3, 276-8(1958) Mar.-Apr. (In Ukrainian)

The aging process in Ti–Cu alloys takes place at 450 to 500°C. The intermediate phase has a tetragonal matrix with parameters a = 3.69 A, c = 3.62 A (c/a = 0.98). The stable β phase appears at 600°C. The disintegration begins at 450°C and increases at 500°C. The β phase structure differs considerably from the solid solution structure. (R.V.J.)

3050

CONTROLLED-ATMOSPHERE ARC WELDING. N. E. Weare and R. E. Monroe (Battelle Memorial Inst., Columbus, Ohio). Welding J. (N. Y.) 37, 1169-75 (1958) Dec.

Many of the new engineering metals coming into widespread use in welding applications are sensitive to contamination by gaseous impurities such as oxygen, nitrogen or hydrogen. These metals and alloys may become embrittled or less resistant to corrosion because of gaseous impurities picked up during welding. Carefully controlled welding atmospheres are required to prevent harmful contamination of metals such as zirconium, titanium, molybdenum, hafnium, niobium, and tantalum. The design, construction, and operation of various types of equipment for preventing such contamination are discussed. Controlled-atmosphere equipment may range from large vacuum-purged dry boxes to simple trailing shields for use with standard welding torches. Shielding equipment for open-air use includes cups, trailing and leading shields, dragging shields, and gas backups. Closed-atmosphere equipment discussed includes both flow-purged and vacuum-purged enclosures. (auth)

3051

USE OF RADIOISOTOPES IN FILLER METAL FOR NONDESTRUCTIVE INSPECTION. Paul T. Barnes

(U. S. Naval Ordnance Test Station, China Lake, Calif.) and Gordon L. Locher (Western Radiation Lab., Los Angeles). Welding J. (N. Y.) 37, 1176-81(1958) Dec.

A study of the use of slightly radioactive welding wire as a means of nondestructive examination of uniformity and penetration in a weld with monitoring equipment is presented. Metals considered are alloys of aluminum, iron, and silver. (auth)

3052

JOINING OF ZIRCALOY TO STAINLESS STEEL. J. B. McAndrew, R. Necheles, and H. Schwartzbart (Illinois Inst. of Tech., Chicago). Welding J. (N. Y.) 37, 529s-34s(1958) Dec.

The work reported was undertaken for the purpose of developing a zirconium-to-stainless-steel joint in heavy-wall tubing, the joint to incorporate a metallurgical seal which would not be attacked during long exposure to pressurized high-temperature water. Flash welding and brazing were the joining methods investigated. Some weldments and brazements showed promise of meeting the requirements, but reproducibility of performance among different joints was poor in both cases. Thermally engendered stresses were a major source of difficulty, whereas it appears that the corrosion problem is not insoluble. (auth)

3053

A SURVEY OF THE BONDING OF CERMETS TO METALS. G. R. Van Houten (P. R. Mallory & Co., Inc., Indianapolis). Welding J. (N. Y.) 37, 558s-69s (1958) Dec.

Brazing cermets to metals is complicated by the great differences in thermal coefficients of expansion and by the difficulty in finding braze metals which will wet cermet surfaces. The need for brazes which are strong at high temperatures (and therefore melt at even higher temperatures) further increases the problem of differential expansion. This literature survey reviews metallizing history, joint design, joint materials, methods of wetting, methods of increasing braze strength, methods of correcting for differential expansion, and other topics pertinent to the production of a strong high-temperature braze for cermets. (auth)

3054

NEUTRON STRUCTURAL ANALYSIS OF METALS AND ALLOYS. SURVEY. B. G. Lyashchenko. Zavodskaya Lab. 24, 585-97(1958).

A survey is presented on the developments in neutron structural analysis of metals and alloys. 41 references. (J.S.R.)

3055

A MASS SPECTROMETRIC DETERMINATION OF THE THERMODYNAMIC CHARACTERISTICS OF BINARY METALLIC SYSTEMS. A. P. Lyubimov, V. Ya. Zobens, and V. I. Rakhovskii (Stalin Inst. of Steel, Moscow). Zhur. Fiz. Khim. 32, 1804-8(1958) Aug. (In Russian)

A new method is described for determining the partial vapor pressures of components of binary metallic systems. The intensity of ionic currents of chief isotopes of the components was measured with the aid of a mass spectrometer. The equality of the ratio between the ionic currents of the components and the ratio between the component concentrations permits the determination of the partial vapor pressures of the components, using a transformed Gibbs–Duhem equation. The method was verified on the binary mixtures Fe–Ni and Fe–Co investigated at 1463, 1583, and 1703°K. It was established that the system Fe–Ni deviates a little from Raoult law in the region of 0.792 molar fractions Ni, whereas the system Fe–Co is close to ideal. (tr-auth)

3056

THERMAL CAPACITY OF NICKEL, STRONTIUM, AND ZINC TUNGSTATES AND OF BARIUM AND STRONTIUM MOLYBDATES AT ELEVATED TEMPERATURES. L. A. Zharkova and T. N. Rezukhina (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 32, 2233-5 (1958) Oct. (In Russian)

The mean thermal capacities of $NiWO_4$, $SrWO_4$, $ZnWO_4$, $BaMoO_4$, and $SrMoO_4$ were measured with the aid of a massive calorimeter over temperatures ranging from 683.2 to 293.2°K to 1125.2 to 293.2°K, and equations are presented for calculating the mean and true thermal capacities of these salts within this temperature range. (tr-auth)

3057

A STUDY OF THE PHASE DIAGRAM OF THE SYSTEM ZIRCONIUM–BORON. V. A. Epelbaum and M. A. Gurevich (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 32, 2274-81(1958) Oct. (In Russian)

The formation of the phase ZrB_2 in the region of the compositions $Zr-ZrB_{2,68}$ was investigated by chemical and x-ray techniques. Zirconium 99.6% pure and boron 99.3 to 99.6% pure were used as initial materials. The synthesis was carried out at 1900 to 2100°C in an argon atmosphere and in vacuum. The formation of the phase ZrB_2 takes place at small boron contents, corresponding approximately to the composition $ZrB_{0.02-0.03}$. Over the entire composition range the periodicity of the hexagonal lattice of the ZrB_2 phase remains practically unchanged, within the limits of precision of the measurements (± 0.001 kX), and is equal to $a = 3.162_5 \pm 0.0003$ kX, $c = 3.522_5 \pm 0.0003$ kX, $c/a = 1.113_8$. The phase ZrB_2 evidently has a narrow region of homogeneity. (tr-auth)

3058

THE EFFECT OF OXIDE MELT COMPONENTS ON THE INTERFACIAL TENSION WITH IRON. S. I. Popel (Kirov Urals Polytechnic Inst.). Zhur. Fiz. Khim. 32, 2398-2402(1958) Aug. (In Russian)

The interfacial tension (σ) was determined at 1580°C with the aid of x-ray photography. For the melts $CaO-SiO_2-Al_2O_3$, it is high (1060–1290 erg/cm^2) and slightly increases on changing the silicon dioxide with calcium or aluminum oxides. Enrichment of the oxide phase in ferrous oxide is accompanied by a large decrease in the interfacial tension. The high σ values bear witness to weak interaction between the phases. On introducing FeO to the slag both melts become enriched in related particles (iron and oxygen), the adsorption of which leads to decrease in the asymmetry of the field of force at the interfacial boundary, and, hence, to insignificant values of σ. (tr-auth)

3059

CATHODIC POLARIZATION IN TITANIUM CONTAINING SLAGS. V. I. Musikhin and O. A. Esin (Inst. of Metallurgy, Sverdlovsk). Zhur. Fiz. Khim. 32, 2410-14(1958) Oct. (In Russian)

The polarization accompanying the complete and partial reduction of titanium ions in melts of the oxides $CaO-MgO-Al_2O_3-B_2O_3-TiO_2$ on Cu, Ti, Fe, P, Ti, and W cathodes was measured at 1375 to 1400°C by the commutator method. The curves obtained are well described by concentration polarization equations, bear-

ing evidence of the diffusion character of the process. (tr-auth)

3060

THE PRESENT STATE OF INVESTIGATION OF THE BORON CARBON DIAGRAM. G. V. Samsonov (Inst. of Metal Ceramics and Special Alloys, Kiev). Zhur. Fiz. Khim. 32, 2424-9(1958) Oct. (In Russian)

Based on a comparison of the data on the properties of alloys of the system boron–carbon a tentative diagram was plotted for the system within the concentration limits 0 to 80% carbon. (tr-auth)

3061

INVESTIGATION OF THE INDUSTRIAL ETCHING OF THE SURFACE OF MONOCRYSTALLINE GERMANIUM BEFORE FUSING INDIUM INTO IT. R. E. Smolanskii, V. M. Gurevich, A. M. Raikhlin, and M. I. Lukasevich. Zhur. Tekh. Fiz. 28, 2135-41(1958) Oct. (In Russian)

Effects of industrial etching on a germanium surface and on the thickness of distortion after cutting and polishing were determined. Some theories are suggested with respect to various sorption properties of germanium treated with alkali and oxalic etching. Data are offered on germanium etching in manufacturing various apparatuses containing indium–germanium with p-n transition. (tr-auth)

3062

KRATKIY SPRAVOCHNIK PO OBRABOTKE TSVETNYKH METALLOV I SPLAVOV. (Handbook on Working of Nonferrous Metals and Alloys). Nikolay Zinov'yevich Dnestrovskiy and Sergey Nikolayevich Pomerantsev. Moscow, Metallurgizdat, 1958. 406p.

The basic properties of the most widely used nonferrous metals and alloys (Al and its alloys, Mg and its alloys, Cu, Cu–Zn alloys, Sn bronze, Sn-free bronze, Ni, Ni–Cu alloys, Sn, Pb, Sn babbits, Ca babbits, Zn and its alloys, solders, Ti and its alloys, Zr, and thermostatic bimetals) are discussed. The methods for cold and hot forming are discussed. Formulas for the calculation of basic data in rolling, drawing, and pressing are given. (J.S.R.)

3063

PRIMENENIYE NOVYKH TEKHNOLOGICHESKIKH PROTSESSOV SVARKI. (Application of New Welding Techniques.) Mendel' Saulovich Kerner. Leningrad, Sudpromgiz, 1958. 132p.

Industrial experiences with various types of electric-arc and resistance welding are presented. Different types of automatic and semi-automatic welding equipment and the welding techniques used are described. (J.S.R.)

3064

THE METAL THORIUM. Proceedings of the Conference on Thorium Held October 11, 1956 at Cleveland, Ohio. Harley A. Wilhelm, ed. Cleveland, American Society for Metals, 1958. 402p.

The following topics were presented at the conference: role of Th metal in the nuclear field; nonnuclear application of Th; Th in Mg technology; production of Th compounds; preparation of ThO_2 and ThF_4 from $Th(NO_3)_4$; development of the thorium tetrafluoride–calcium process for thorium metal; preparation of iodide Th; consumable-electrode arc melting of Th; electrolytic refining of Th; physical constants, crystal structure, and thermodynamic properties; electronic structure of Th metal; preferred orientation in Th; mechanical properties of Th and high-Th alloys; recrystallization of Th; fabrication and cladding of Th metal; corrosion of Th and its alloys; effects of irradiation on Th; metallography of Th; hazards associated with Th Metallurgy; constitution of Th alloys; chemical analysis of Th metal; and spectrographic analysis of Th. (W.L.H.)

3065

THE METALLURGY OF VANADIUM. William Rostoker. New York, John Wiley & Sons, Inc., 1958. 192p.

The extractive metallurgy, physical properties, constitution, mechanical properties, oxidation, corrosion and embrittlement, and metallography of vanadium are presented. (W.L.H.)

3066

ZONE MELTING. William G. Pfann. New York, John Wiley & Sons, Inc., 1958. 246p.

The normal freezing and the distribution coefficient in zone melting are presented. The theory of zone refining is discussed. Various techniques of zone refining are presented. The applications of zone refining to semiconductors, metals, and chemicals are discussed. The principles of continuous zone refining are presented. Zone leveling and single-crystal growth are discussed along with methods of perturbing the concentration and temperature-gradient zone melting. (W.L.H.)

3067

1957 REFERENCES ON FATIGUE. STP No. 9-1. Sponsored by ASTM Committee E-9 on Fatigue. Survey Subcommittee III. Horace J. Grover, Chairman. Columbus, Ohio, Battelle Memorial Inst., 1957. 64p. $3.00.

A list of references to articles published in 1957 dealing with fatigue of structures and materials following the plan used in previous annual lists from 1950 through 1956 is presented. Brief abstracts are included when these were readily available. (auth)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

3068 CERN-PS/CS-2

European Council for Nuclear Research, Geneva.
NOTE ON THE APPLICATION OF NUCLEAR RESONANCE TO PROTON SYNCHROTRON FREQUENCY CONTROL. Ch. Schmelzer. Oct. 31, 1952. 7p.

Nuclear-resonance-regulated oscillators for frequency control in proton synchrotrons are discussed. Higher cost of the arrangement is offset by high inherent stability. The problem of computing the frequency program is simplified. (A.C.)

3069 CERN-PS/CS-11

European Council for Nuclear Research, Geneva.
A NUCLEAR RESONANCE CONTROLLED RF GENERATOR. II. EXPERIMENTS WITH DIRECT FEED-BACK THROUGH THE SPIN-SYSTEM (TYPE A GENERATOR). Ch. Schmelzer and W. Schnell. July 30, 1953. 5p.

Experimental results have previously been presented (CERN-PS-CS-10) for a Type B generator in which the frequency of an ordinary RF generator is regulated by an error signal derived from nuclear resonance. The system, though imperfect, approached in performance the conditions necessary for its application as a master oscillator in the RF system of a large proton synchrotron. An improved Type A generator is described in which the nuclear signal is fed directly back into the input of the broad-band amplifier. Experimental results indicate the possibility of constructing a nuclear-spin-

controlled oscillator of Type A. Plans for further development of Type B generator have been dropped. (A.C.)

3070 CERN-PS/JBA-MGNH/22
European Council for Nuclear Research, Geneva.
THE VARIATION OF THE PARAMETERS OF A 25 GEV ALTERNATING GRADIENT SYNCHROTRON WITH μ AND n. July 1, 1954. 69p.

Before computing the parameters for the "Conference Machine," an attempt was made to find an optimum value for N, the magnetic field index. Furthermore, no serious attempt had been made to determine the optimum value for μ, the phase shift of the betatron oscillation per magnet period, in the first design. A program of investigation was planned to present in an easily digestible form how each of the many parameters of an alternating-gradient machine varies with μ and with N. This report gives the results of this investigation and summarizes the conclusions which have been reached. The report ends with a discussion of the results of the computations taking into account the magnet design, the over-all mechanical design, the design of the r-f accelerating units and the correcting lenses, and the layout and use of the machine. (A.C.)

3071
MEASUREMENT OF AZIMUTHAL INHOMOGENEITY OF MAGNETIC FIELD OF BETATRON AT 15 Mev. Ladislav Sipek (Higher Inst. for Vacuum Electrotechnics, Prague). Czechoslov. J. Phys. 7, No. 4, 393-5(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1958, Abstract No. 7632.)

The methods usually used for measuring the azimuthal inhomogeneity of the magnetic field of a betatron at 15 Mev were unsuitable because of the low frequency of the exciting current. Another method is suggested. A standard permalloy probe is fastened between the poles of the magnet. Another probe is guided over the equilibrium orbit. The pulses from both probes are applied to a synchroscope and the deviation of the measuring probe from that of the standard probe is read. The accuracy of the measurement is 3%. (TCO)

3072
ON THE THEORY OF THE LINEAR BETATRON. M. V. Konjukov (Tula Pedagogical Inst.) and J. P. Terletskij (Moscow State Univ.). Nuovo cimento (10) 9, 930-41(1958) Sept. 16.

Three cases of electron motion in an axially symmetric magnetic field displacing along the axis are discussed: 1) the magnetic field is displacing in such a manner that the electron orbit radius remains constant; 2) the magnetic field is displacing uniformly with the constant velocity $u < c$; and 3) the magnetic field is displacing with the light velocity c. The gained energy, the time and path of acceleration are calculated for each of the three cases. The results can be considered as a theoretical basis for linear betatrons. (auth)

3073
OSCILLATION EXCITATION IN ELECTRON CYCLIC ACCELERATOR BY RADIATION QUANTUM FLUCTUATIONS. Yu. F. Orlov and E. K. Tarasov. Pribory i Tekh. Ekspt. No. 5, 17-20(1958) Sept. (In Russian)

Mean square amplitudes of phase and radial oscillations are derived with consideration for magnetic field variations along the orbit, which are possible in accelerators with strong focusing. The tie between the phase and radial oscillation indexes are taken into account. (tr-auth)

3074
THE BROOKHAVEN ALTERNATING GRADIENT SYNCHROTRON. R. A. Beth and C. Lasky (Brookhaven National Lab., Upton, N. Y.). Science 128, 1393-1401 (1958) Dec. 5.

The Brookhaven AGS, a 25-Bev proton synchrotron, is described briefly, and the principal physical ideas involved are outlined. The organization, precision, and range of special technologies involved in this project are given. (T.B.A.)

3075
ON THE CAPTURE MECHANISM AND LIMITING CURRENT IN BETATRONS. A. N. Matveev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 372-80 (1958) Aug. (In Russian)

The mechanism of electron capture in a betatron is considered by taking into account Coulomb interaction of the electrons in the beam and electron losses on the walls of the vacuum chamber. The problem can be solved to the end for a simplified model. It is found that the mechanism under consideration is highly effective and in agreement with experiment. A formula for the limiting current is presented which is also valid for relativistic electron energies. (tr-auth)

3076
MECHANISM OF THE FREE OSCILLATION DAMPING IN CYCLIC ACCELERATORS. Yu. F. Orlov (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 525-7(1958) Aug. (In Russian)

In previous works contentions were made about the absence of damping in betatron oscillations related to the electron accelerator emissions. It is shown that in reality the ordinary adiabatic damping as well as damping related to the emission appears as the result of rectification of the beam passing through acceleration interspace. (R.V.J.)

3077
CALORIMETRIC MEASUREMENT OF THE GAMMA-RAY ENERGY FROM A SYNCHROTRON. S. P. Kruglov. Zhur. Tekh. Fiz. 28, 2310-23(1958) Oct. (In Russian)

Descriptions are given of the design and performance of a calorimeter adapted for measuring the γ-ray energy flux up to 500 Mev. The increased temperatures were measured with thermistors. Calorimetric calibrations were accomplished with the aid of heating elements placed in lead cylinders. A design is offered for cylinders acting as good thermal contacts between the heater and the mass. Maximum calibrating error did not exceed 1%. Results of measurements taken of the energy flux from the bremsstrahlung of γ radiation from the synchrotron of three maximum energies are presented. Results obtained with absorption cylinders 4 and 11 cm long agree within the limits of error. (tr-auth)

PHYSICS AND MATHEMATICS

General

3078 AECU-3902
Oak Ridge Gaseous Diffusion Plant, Tenn.
MULTICOMPONENT FRACTIONATION. E. Von Halle. Aug. 1, 1956. Appendix I: MULTICOMPONENT PRODUCTIVITY. G. B. Knight. Appendix II: EXTRAPOLATION PROCEDURE. G. B. Knight. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A mathematical analysis is presented of the fractionation of multicomponent mixtures of gaseous isotopes through a barrier. (W.L.H.)

3079 AECU-3903
Oregon. Univ., Eugene.
EFFECT OF THERMAL MOTION ON THE X-RAY REFLECTIVITY OF QUARTZ. D. W. Berreman and TeTse Chang. [1954]. 23p. $4.80(ph OTS); $2.70(mf OTS).

The magnitude of the effect of crystal lattice thermal motion on the hard x-ray and gamma-ray reflectivity of various sets of Bragg planes in quartz was investigated. The research was conducted by measuring the relative values of hard x-ray reflectivity from different sets of Bragg planes and calculating the two different approximate Debye characteristic temperatures of quartz by relating these temperatures to the elastic constants of monatomic crystals of any form. The experimental equipment and techniques are described, and the results are discussed in detail, including theoretical aspects. (J.R.D.)

3080 AECU-3906
Chicago. Univ.
RESEARCH ON THE NATURAL ABUNDANCE OF DEUTERIUM AND OTHER ISOTOPES IN NATURE. [Final Report for Period Ending September 30, 1958]. Harold C. Urey. 10p. Contract AT(11-1)-101. $1.80 (ph OTS); $1.80(mf OTS).

A bibliography, containing about 78 references, on the natural abundance of deuterium and other isotopes in nature is presented. (W.L.H.)

3081 AECU-3915
Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY ON METHODS OF PRODUCING AEROSOLS, VAPORS AND GASES AS TEST ATMOSPHERES. Ruth M. Hendrickson, comp. May 20, 1958. 44p. Contract [W-7405-eng-36]. (D-BIB-26). $7.80 (ph OTS); $3.30(mf OTS).

The literature from 1928 to 1958 was searched for information on methods of producing aerosols, vapors, and gases for use as test atmospheres. (C.H.)

3082 AECU-3922
RAND Corp., Santa Monica, Calif.
HYDROGENIC BOUND-FREE GAUNT FACTORS. W. J. Karzas and R. Latter. Jan. 15, 1958. 38p. Contract AT(29-1)-1477. (RM-2091-AEC; AD-205873). $6.30 (ph OTS); $3.00(mf OTS).

The gaunt factors for bound-free absorption in a pure Coulomb field are computed for bound states through the 15th shell and for free electron energies E/Z^2 from 2.5×10^{-3} to 4×10^4 Rydbergs. The results are presented in tables and graphs and include also the gaunt factors averaged over a complete shell. (auth)

3083 AECU-3923
RAND Corp., Santa Monica, Calif.
RELATIVISTIC SELF-CONSISTENT CALCULATION FOR THE NORMAL MERCURY ATOM. Stanley Cohen. July 28, 1958. 69p. Contract AT(11-1)-135. (RM-2272-AEC; AD-205872). $10.80(ph OTS); $3.90(mf OTS).

A presentation is given of the relativistic self-consistent solutions of the Hartree type for the normal mercury atom. The single-particle wave functions making up the atomic wave function are assumed to be solutions to the relativistic Dirac equation. The study describes the technique and numerical methods used to obtain these results. The eigenvalues obtained with both the results of the previous nonrelativistic calculation and with the experimental-term values are compared. It is shown that appreciable corrections to the eigenvalues are made by including the relativistic effects. (auth)

3084 AERE-EL/M-105
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE USE OF INDUCED N^{16} ACTIVITY IN A REACTOR COOLANT FOR THE DETERMINATION OF NEUTRON FLUX DISTRIBUTION. A. Goodings. 1958. 14p.

The possibility of using induced coolant activity to study the integrated neutron flux along a fuel element channel is discussed. It is concluded that the technique may be useful, and possible lines of further study are proposed. (auth)

3085 AERE-NP and R/R-2651
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
STABLE AND LONG LIVED FISSION PRODUCTS OF IMPORTANCE TO REACTORS. N. J. Pattenden and H. Rose. May 1958. Revised July 1958. 15p. $0.35 (BIS). (NPCC/RPWP/P135).

A revised and declassified version of NRDC-105 (TNCC(UK)-29)).

The low energy neutron cross sections of important fission products are tabulated, and the current state of knowledge is critically reviewed. Some recommendations are made for future work. (auth)

3086 AERE-R/M-209
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A SIMPLE THEORY FOR FLUX DEPRESSIONS CAUSED BY LOOPS IN A REACTOR. C. Carter. Sept. 1958. 13p.

Two models are used to obtain formulas for the flux depressions caused by a loop in the reactor core and in the reflector. (auth)

3087 AERE-R/R-2568
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
NEUTRON STREAMING IN GAS-COOLED REACTORS. I. S. Grant. Oct. 1958. 25p. $0.56(BIS).

Calculation of the leakage in reactor lattices containing cooling channels is discussed in terms of diffusion theory. Anisotropic diffusion coefficients are proposed which make allowance for the effect of the fine structure of the neutron distribution across a lattice cell. (auth)

3088 AERE-RP/R-1827
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INTERPRETATION OF FINE STRUCTURE MEASUREMENTS. PART II. NATURAL WATER-URANIUM LATTICES. J. E. C. Mills and D. A. Newmarch. Aug. 1957. Changed from OFFICIAL USE ONLY May 1958. 19p. $0.42(BIS).

Diffusion theory was used to analyze fine structure experiments on natural water moderated uranium assemblies. Natural and slightly enriched uranium in the

form of rods which are canned in aluminum or stainless steel sheaths was examined in various lattice arrays. (auth)

3089 AERE-T/M-170

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AMENDMENTS TO CARLSON'S SNG CODE. M. E. Mandl. Oct. 1958. 13p.

Amendments were made to Carlson's SNG code so that: (i) perpendicular buckling corrections can be made to the cross sections; (ii) only a specified region of the system is scaled in a critical size calculation, instead of the whole system; (iii) the variation of parameters can be delayed if required; and (iv) a print of $r_i + r_{i+1}/2$ is included in the final print. (auth)

3090 AFOSR-TN-58-1003

Stanford Univ., Calif.

NUCLEON CORRELATION EFFECTS IN HIGH-ENERGY ELECTRON SCATTERING. Technical Report No. 33. W. E. Drummond. June 1958. 39p. Project No. 9750-37500. Contract AF49(638)-388. (AD-206146).

Schiff's high-energy approximation was used to develop a sum rule which relates the scattering of high-energy electrons from heavy nuclei to the two-particle correlation function for the nucleus. It is shown that correlations due to the Pauli principle give a large effect in the region of momentum transfer from 100 to 300 Mev/c, and that correlations with a range of less than one fermi do not make appreciable contribution. (auth)

3091 APEX-387

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SHIELDING COMPUTER PROGRAMS. M. A. Capo. Oct. 29, 1957. 22p. Contracts AF33(600)-38062 and AT(11-1)-171. $0.75(OTS).

Digital-computer shielding-nuclear analysis programs are described. Each description includes (1) the purpose of the program, (2) the theoretical or physical assumptions, and (3) the major computer equipment required by the program. (auth)

3092 APEX-427

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

A STUDY OF SHARE MATRIX PROGRAMS. R. G. Herrmann and M. R. Smith. Sept. 23, 1958. 10p. Contract [AT(11-1)-171]. (XDC-58-9-204). $1.80(ph OTS); $1.80(mf OTS).

A study of matrix programs was undertaken to determine the relative merits of SHARE available programs for the inversion of matrices and for the solution of linear algebraic equations. (auth)

3093 APEX-432

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SHADOW SHIELDS AND SCATTERED GAMMA RADIATION (thesis). Robert E. Baker. June 1957. 43p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.50 (OTS).

Submitted to Vanderbilt Univ.

It is extremely difficult to predict the gamma ray intensities arriving at a point which is completely shielded from the primary gamma rays traveling a line-of-sight path but relatively unshielded from the scattered gamma rays which arrive at the receiver point from various angles. In order to obtain data which will yield a better general understanding of the importance of the scattered component, a series of investigations were undertaken to show the effect of incremental changes in some of the variable quantities involved in a source-barrier-detector arrangement in a scattering medium. (W.D.M.)

3094 BNL-485

Brookhaven National Lab., Upton, N. Y.

CAPTURE–POSITRON RATIOS FOR ALLOWED AND FIRST-FORBIDDEN TRANSITIONS. M. L. Perlman and M. Wolfsberg. Jan. 1958. 7p. $0.50(OTS).

3095 CF-58-9-39

Oak Ridge National Lab., Tenn.

SOME STUDIES OF WATER, STYROFOAM AND PLEXIGLAS REFLECTORS. J. K. Fox and L. W. Gilley. Oct. 3, 1958. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The reflecting properties of water, Styrofoam, and plexiglas were studied in critical experiments with 6-in.-thick slabs of aqueous solutions of UO_2F_2 enriched to 93% in U^{235}. It was found that Styrofoam is significantly less effective than water as a neutron reflector, since the height of a slab with an effectively infinite Styrofoam reflector (except on top) was reduced by only about 20% from that of the unreflected slab, while the height of a slab with an effectively infinite water reflector was reduced by more than a factor of 3. The effects of placing water, Styrofoam, and plexiglas between two-slab assemblies, both unreflected and water-reflected, were also investigated. (auth)

3096 GMR-107

General Motors Corp. Research Staff, Detroit.

TRANSVERSE LEAKAGE SPECIFICATION IN MULTI-GROUP PSEUDO-ONE-DIMENSIONAL PROBLEMS. A. Foderaro. [1957]. 29p.

A method is described for specifying the transverse leakage ("buckling") in each energy group of a multigroup solution of the neutron transport equation. As applied to a completely reflected finite cylindrical core, the method consists in using the calculated absorptions in the core and leakages from the core from a one-dimensional multigroup run to calculate more exact group bucklings to be used in the next iteration in the other direction. The process is repeated until the buckling in each group in each direction converges. The converged value of the multiplication constant or the criticality parameter, if one is used, is found to be independent of the initial guess made for the axial or radial buckling. The IBM-704 multigroup age diffusion code GNU was used in conjunction with this "buckling iteration method" to compute the equivalent spherical radii of a number of fully reflected finite cylindrical cores for which experimental data are available. These results are compared with those obtained by the use of other prescriptions for calculating the reactivity of cylindrical cores. There is a brief discussion of the extension of the buckling iteration method to other than cylindrical cores. (auth)

3097 HW-57293

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DOUBLE MODERATOR NEUTRON DOSIMETER. J. DePangher. July 15, 1958. 45p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

A moderated BF_3 detector was developed for meas-

uring fast neutron dose, flux and average energy in the laboratory. It is being used for measuring dose in field conditions as well, in spite of its directional cylindrical geometry and its weight, because it is very sensitive to neutrons and quite insensitive to gamma radiation. This instrument, called the "double moderator" and consisting of a "fluxmeter" and a "dosimeter," was calibrated with monoergic neutrons from an accelerator and with neutrons from radioactive sources. Several applications are described. (auth)

3098 HW-57709
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A VARIATIONAL METHOD FOR CALCULATING GEOMETRICAL BUCKLINGS. G. D. Joanou. Oct. 8, 1958. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A variational method is described for determining geometrical buckling for reactors with unsymmetrical or odd shapes. (D.E.B.)

3099 IFA/DF-11
Academia R. P. R. Institutul de Fizică Atomică, Bucharest.
VARIATION OF THE VISCOSITY OF CERTAIN GAS-OXYGEN MIXTURES UNDER THE INFLUENCE OF MAGNETIC FIELD. (Variatia Viscozităţii unor Amestecuri de Gaze cu Oxigen sub Influénta unui Cîmp Magnetic). Ioan Ursu. 1958. 13p.

The paramagnetic effects of oxygen and gas–oxygen mixtures are discussed. One of the paramagnetic effects is the variation of viscosity during the viscous flow in a magnetic field. The viscosity of gaseous oxygen and certain gas–oxygen mixtures decreased when the flow occurred in a magnetic field. The dependence of this effect on the size of the capillaries and porous materials was investigated. The viscosity was also found to vary with the concentration of oxygen and the other components forming the mixture. The results of the investigations with various gas mixtures are graphically shown. (A.C.)

3100 KAPL-1886
Knolls Atomic Power Lab., Schenectady, N. Y.
THE MULTIGROUP DIFFUSION EQUATIONS OF REACTOR PHYSICS. G. J. Habetler and M. A. Martino. July 28, 1958. 54p. Contract W-31-109-Eng-52. $1.50(OTS).

The partial differential equations of the multigroup diffusion model of reactor physics are shown to have solutions both in the time-independent and time-dependent problems, and the usually assumed behavior of these solutions is shown to be mathematically valid. The method of spectral representation is developed for the multigroup diffusion operator. (auth)

3101 KAPL-M-RMM-3
Knolls Atomic Power Lab., Schenectady, N. Y.
A GENERALIZATION OF CUMULATIVE DAMAGE. R. M. Mains. Oct. 6, 1958. 28p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

In the application of various damage accumulation hypotheses to shock and vibration problems, a pattern of results was observed. A plot of allowable response (for the largest of a sequence of excitations) versus the number of excitations in the sequence produced straight lines on log-log paper for each value of damping. It seemed likely that a generalization could be found which would relate the allowable response to the largest excitations with a load-distribution factor, a material-and-structure factor, and the material constants from fatigue tests. One form of this generalization is presented, together with some numerical examples of its use and a discussion of its possible significance. (auth)

3102 KAPL-M-S3G-RES-60
Knolls Atomic Power Lab., Schenectady, N. Y.
ARC—A STEADY STATE THERMAL ANALYSIS CODE FOR THE IBM-704 EDPM. T. A. Conery and J. W. Millard. Nov. 12, 1958. 53p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

In the design of a nuclear reactor, it is necessary to determine the thermal operating characteristics of the core. An analysis is presented of the steady-state problem together with an IBM 704 code, entitled ARC, which is used to obtain a solution. The analysis and coding are sufficiently flexible to permit their use for any one- or two-pass reactor core in which a liquid coolant is used and no change of phase is involved. In addition, mixed geometries may be handled directly by the code. The output of the code includes peak conditions and certain average conditions of interest. At the discretion of the programmer, nodal variation of the important thermal conditions can also be obtained. (auth)

3103 NP-7028
Midwest Research Inst., Kansas City, Mo.
ON ECONOMIC REPRESENTATIONS OF TRANSCENDENTAL FUNCTIONS. Technical Report. Yudell L. Luke. Feb. 3, 1958. 47p. MRI Project No. 2069-P. Contract N600(167)44908.

The generation of rational approximations for a wide class of transcendents is described. The technique stems from an idea of Bellman who considered the exponential integral and the error function. Economic representations are given of a Laplace integral, elements of the Padé table, generalized hypergeometric series, the continuants of Gauss, Whittaker functions and wave functions in a Coulomb field, the modified Bessel function $K_\nu(z)$, Struve functions, Weber parabolic cylinder functions, and the Bessel functions $J_\nu(z)$ and $Y_\nu(z)$. (L.T.W.)

3104 NP-7060
Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.
FISSION OF U^{238} NUCLEI WITH μ-MESONS. A. K. Mihul and M. G. Petrashcu. 1958. 6p.

Some 26,975 μ^- meson events in nuclear plates loaded with uranium were considered, yielding 59 fission events. (A.C.)

3105 NP-7063
Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.
ON VERIFICATION OF INTERACTION INVARIANCE UNDER TIME REVERSAL. L. I. Lapidus. 1958. 4p.

The possibility of a direct experimental check of the invariance of different interactions under time reversal based on the relation between polarization phenomena in inverse reactions is indicated. (A.C.)

3106 NP-7072
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
INVESTIGATIONS OF BREMSSTRAHLUNG OF ELECTRONS IN THE ENERGY INTERVAL 10^{11}–10^{12} eV. Report No. 39/VI. J. Benisz, Z. Chyliński, and W. Wolter. Nov. 1958. 14p.

Four high-energy ($\sim 10^{12}$ ev) electron-photon cascades have been investigated at the first stage of their development. The number and the energy of the electron pairs

of the first generation produced on the first radiation length were estimated and compared with the theoretical values calculated on the basis of the theory of Bethe and Heitler. On the other hand the same was calculated according to theories of Landau, Pomeranchuk, and Ter-Mikaelyan which take into account the influence of medium on the bremsstrahlung of electrons of very high energy. The experimental results are in better agreement with the predictions of Landau, Pomeranchuk, and Ter-Mikaelyan than with that of Bethe and Heitler. This fact confirms earlier results. (auth)

3107 NRL-5213

Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART IX. MEASUREMENT OF FAST-NEUTRON BEAM CURRENTS. F. E. Jablonski and A. F. DiMeglio. Sept. 4, 1958. 13p.

In many beam-port physics experiments using reactors, low-energy (thermal) neutrons are required and high-energy (fast) neutrons constitute background. In the water-moderated NRL Research Reactor, the energy integrals of the fast and thermal neutrons are of the same order of magnitude. To overcome this situation and to increase the thermal-to-fast-neutron ratio, a split core has been proposed. A split core is one in which the beam ports view only unfueled regions in the reactor core. An experimental comparison has been made of the fast-neutron beam currents emerging from a mock split core and a normal core. It has been experimentally shown that the fast-neutron background at 4.5 Mev can be reduced by about a factor of 10 through the use of a split core. (auth)

3108 NYO-8674

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
A NON-RANDOM SAMPLING METHOD, BASED ON CONGRUENCES, FOR "MONTE CARLO" PROBLEMS. R. D. Richtmyer. Sept. 26, 1958. 41p. Contract AT(30-1)-1480. $7.80(ph OTS); $3.30(mf OTS).

The theory of systematic sampling, a possible competitor to random sampling for problems of Monte-Carlo type, is discussed. It is based on the asymptotic distribution, in the unit cube in a space of many dimensions, of a sequence of points generated by congruences (mod 1) of the multiples of a vector with independent irrational components. Theorems based on algebraic number theory, and ones based on a statistical treatment, concerning the rate of decrease of the error with increasing sample size, are given. The method is illustrated by application to a simple, multiplicative, stochastic problem. The error is seen to be substantially smaller than when the sequence of points in the unit cube is a random one. This is strongly suggested by the algebraic theorems and confirmed by the statistical theorems; however, it is likely that, in practical Monte Carlo problems of the usual complexity, the improvement over random sampling will be evident only for very large sample sizes. (auth)

3109 NYO-8675

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
SIMULTANEOUS, SUCCESSIVE AND ALTERNATING DIRECTION ITERATION SCHEMES. J. Heller. Oct. 1, 1958. 54p. Contract AT(30-1)-1480. $9.30(ph OTS); $3.60(mf OTS).

The linear systems approximating, in the lowest order of approximation, the 2pth order elliptic differential equation is derived. The connection between the simultaneous and successive iteration schemes is studied. In the case of difference equations in two dimensions which are separable the simultaneous, successive, and alternating-direction iteration schemes are studied in detail. In particular, the eigenvalues and eigenvectors of the error matrix are explicitly obtained. (auth)

3110 RDB(W)TN-79

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
SOME NOTES ON ALPHA ASSAY BY THE COUNTING OF THICK SOURCES. T. E. F. Carr and G. S. Murray. 1958. Date of MS. Aug. 1953. 9p.

Some work on the preparation and use of standard sources in the alpha assay of soils and biological ashes is described. It is shown that in the case of adsorbed activity, particle size should be taken into account if errors are to be avoided. (auth)

3111 RM-1974(RAND)

RAND Corp., Santa Monica, Calif.
THEORETICAL SOLUTIONS OF SPHERICAL SHOCK TUBE BLASTS. Harold L. Brode. Sept. 4, 1957. 76p. (AD-206491).

A description is given of the results of calculations on two types of explosions which correspond to recent experimental work at the University of Toronto Institute of Aerophysics. These experiments involve the explosion of gas-filled glass spheres (initially) at room temperature and at pressures of around twenty atmospheres. (auth)

3112 SCR-60

Sandia Corp., Albuquerque, N. Mex.
A THEORETICAL TREATMENT OF ELECTRIC BREAKDOWN IN BARIUM TITANATE. Edmund G. Franzak. Dec. 1958. 46p. Contract AT(29-1)-789. $7.80(ph OTS); $3.30(mf OTS).

A method is developed based on an essentially rigid ion hypothesis for the calculation of the electric breakdown field strength in ionic crystals. The basic mechanism responsible for breakdown is assumed to be an electron avalanche effect, and the theory rests on a calculation of the rate at which a conduction electron gains energy from the applied field and loses energy to the lattice vibrations. To this end, the effect of the lattice vibrations is treated by means of a time-dependent perturbation theory. The ionic nature of barium titanate is assumed, and a calculation of the breakdown field strength is made for a single crystal at 150°C in the cubic nonferroelectric phase. A value of 16.9×10^6 volts/cm is obtained. The limitations and assumptions of the theory are discussed, and suggestions for improvement are made. (auth)

3113 SCTM-233-58(51)

Sandia Corp., Albuquerque, N. Mex.
THE CONSTRUCTION OF UNDERGROUND OIL STORAGE TANKS UTILIZING NUCLEAR EXPLOSIVES. Roland H. Carlson. Apr. 1958. 24p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

An investigation is made of the feasibility of constructing underground oil storage tanks or surface reservoirs with the aid of nuclear explosives. Rainier data are extrapolated upward to estimate the higher nuclear explosive capabilities for creating underground cavities. Extrapolation to media other than Rainier is briefly discussed. Consideration is also given to industrial sentiment, conventional construction costs, nuclear construction techniques, and other associated problems. It is con-

cluded that a nuclear application to the oil storage problem is feasible where nuclear dollar charges are less than the conventional construction costs quoted. (auth)

3114 SCTM-341-58(51)
Sandia Corp., Albuquerque, N. Mex.
ON AN INTEGRAL EQUATION ARISING IN THE THEORY OF SPACE CHARGES. I. I. Kolodner. Oct. 16, 1958. 15p. Contract AT(29-1)-789. $3.30 (ph OTS); $2.40(mf OTS).

The equation $v''(x) = a\int_0^x d\xi/\sqrt{v(x)-v(\xi)}$, $v(0) = \alpha$, $v'(0) = \beta$ occurs in the theory of space charges. When $a = 0$, or when $\beta = 0$, an explicit solution can be obtained. All other parameter values are covered by considering two special cases: (1) $\alpha = 0$, $\beta = 0$, $a = 1$; (2) $\alpha = 0$, $\beta = 1$, $a = -1$. Existence and uniqueness of solutions are demonstrated, and in Case 1, formulas for upper and lower bounds for $w(x) = v'(x)$ are derived. These yield $w(x)$ with a relative error approaching 2.91 percent as $x \to \infty$, which does not exceed, however, 12 percent for all $0 \leq x < \infty$. (auth)

3115 UCRL-5253
California. Univ., Livermore. Radiation Lab.
INDUSTRIAL USES OF NUCLEAR EXPLOSIVES. PLOWSHARE Series Report No. 1. Harlan Zodtner, ed. Sept. 8, 1958. 96p. Contract W-7405-eng-48. $1.75 (OTS).

A Symposium on the Industrial Uses of Nuclear Explosives was held in Feb. 1957. Topics discussed include: containment of nuclear explosions; the feasibility and economics of power generation by nuclear explosives; radioactivity associated with steam processing; the economics of excavation; determination of surface motion from deep nuclear shots; uses of thermonuclear explosives in the mining industry; the possibility of using nuclear detonations for increasing the yield of oil wells; earth moving with nuclear explosives; containment problems; subsurface nuclear explosions for seismological studies; plutonium breeding; rocket propulsion by means of nuclear explosions; and the feasibility of producing diamonds by nuclear explosions. (C.H.)

3116 UCRL-5347
California. Univ., Livermore. Radiation Lab.
REACTION CROSS SECTIONS OF Pu^{239} FROM 0.5 TO 10.0 MEV. Robert J. Howerton. Sept. 8, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

Reaction cross sections are presented for Pu^{239} from 0.5 to 10.0 Mev for the reactions (n,γ), (n,n'), and (n,2n) and for nonelastic scattering. (auth)

3117 USNRDL-TR-279
Naval Radiological Defense Lab., San Francisco.
CALCULATION OF THE PENETRATION OF GAMMA RAYS THROUGH THE EDGES OF A ½-IN. DIAMETER LEAD COLLIMATOR. C. S. Cook. Nov. 24, 1958. 23p.

Gamma radiation from a point radioactive source located on the axis of a cylindrically-shaped collimator is not sharply defined by the geometrical aperture of the collimator. Instead some of the radiation penetrates the edges of the collimator. Calculations of the magnitude of this penetration have been made for a ½-in. diameter cylindrical aperture in a lead collimator, from point sources 8, 9, 10½, 13, 16, 32, and 48 inches from the detector end of the collimator. From these calculations has been determined the excess area expected in the full energy peak of a pulse-height distribution from a NaI(Tl) crystal spectrometer. The ratio of all counts recorded in the full energy peak to those defined by the geometrical aperture are tabulated. (auth)

3118 WAPD-P-564
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
THE EFFECT OF BURNABLE POISONS ON THE REGENERATION FACTOR, η, FOR SLIGHTLY ENRICHED URANIUM METAL. W. R. Clancey. Nov. 1, 1954. Decl. Oct. 30, 1958. 24p. $4.80(ph OTS); $2.70(mf OTS).

The principle variation in reactivity is due to the variation of the regenerative factor, η, the variation of the other factors being small by comparison. By studying the variations in η for slightly enriched U metal, results are obtained that are generally applicable to reactors using this fuel, since η depends only on the fuel material. The results presented show that it is possible to reduce the total variation in η by using a burnable poison in the fuel material. However, there is usually a sacrifice in lifetime or enrichment cost that must be weighed against the easing of the control problem. The calculations are based on a modification of data obtained for a flux of neutrons with a Maxwellian average temperature of 537°F. The effects of Pu buildup and fission product poisons are explicitly included. A further discussion of the methods and assumptions used in the calculations is given. It is shown that the addition of two burnable poisons to fuel offers only a small improvement over the single poison results. (M.H.R.)

3119 AEC-tr-3467
HYDROMECHANICAL ASPECTS OF CAVITATIONAL EROSION. K. K. Shalnev. Translated by Oak Ridge National Lab. Library Staff from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 1, 52-62(1958). 19p.

Results of experimental investigations on the hydromechanical mechanism of cavitation erosion are presented. Aspects of the mechanism such as the effect of cavitation dimension, the developmental stages of cavitation, and the effects of Reynolds number and flow rate on erosion intensity are investigated in detail. (J.R.D.)

3120 AEC-tr-3488
AN ALGORITHM FOR CONSTRUCTING THE CHEBYSHEV POLYNOMIAL APPROXIMATION TO A CONTINUOUS FUNCTION. S. I. Zukhovitskii (Zukhovitsky). Translated for Oak Ridge National Lab. from Doklady Akad. Nauk S.S.S.R. 120, 693-6(1958). 8p.

3121 NP-tr-198
ON THE USE OF CYCLOTRON RESONANCE IN SEMICONDUCTORS TO AMPLIFY AND GENERATE MICROWAVE OSCILLATIONS. A. S. Tager and A. D. Gladun. Translated for Lincoln Lab., MIT from Zhur. Eksptl'. i Teoret. Fiz. 35, 808-9(1958). 3p.

A mathematical analysis is presented on the use of cyclotron resonance in semiconductors to amplify and generate microwave oscillations. (W.L.H.)

3122 NP-tr-199
EXCHANGE EFFECTS IN FERROMAGNETIC RESONANCE. M. A. Gintsburg. Translated for Lincoln Lab., MIT from Zhur. Eksptl'. i Teoret. Fiz. 35, 1047-9(1958). 3p.

A dispersion law for the transverse electromagnetic and spin waves is found, taking into account both the relativistic and exchange interaction. As the wavelength is shortened, the relative role of the displacement current becomes even less; on the other hand, the contribution of the exchange forces increase and spin waves are obtained in place of transverse electromagnetic waves. (W.L.H.)

3123 AEC-tr-3506

ON THE CAUSES FOR THE DEPENDENCE OF THE LUMINESCENCE YIELD OF ORGANIC SUBSTANCES ON THE ENERGY OF THE IONIZING PARTICLES. (O Prichinakh Zavisimosti Vykhoda Luminestsentsii Organicheskikh Veshchestv ot Energii Ionizuyushchikh Chastits). M. D. Galanin. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 4, 758-62(1958). 7p.

The mechanism of the decrease of luminescence yield of organic substances upon exciting them by charged particles with a large specific energy loss is discussed. An evaluation of the possible effect of temperature quenching of the luminescence in the excitation channel is carried out, and it is indicated that this phenomenon may play an essential part and lead to a strong quenching of the excited molecules formed by the primary particle. It is postulated that for a high ionization density a substantial part of the luminescence is caused by secondary particles. (auth)

3124 SCL-T-208

INVESTIGATION OF THE SHAPE AND SIZE OF MACROMOLECULES BY THE METHOD OF ELECTRON MICROSCOPY. T. A. Koretskaya (Koretskaia) and V. L. Karpov. Translated by Marcel I. Weinreich (Sandia Corp.) from Doklady Akad. Nauk S.S.S.R. 111, 621-2(1956). 4p.

The method of investigating the forms and dimensions of single polymer macromolecules with an electron microscope is discussed. The method consisted of applying the substance under investigation on a film after dilution in a solution. The supporting film consisted of a material which could swell in the solvent used. After several hours of exposure to the atmosphere saturated with the vapors of the solvent, a droplet was removed from the film by means of a pipet. Polyacrylate and polymethacrylate of thallium were introduced into the investigated substances to increase contrast in the microscopic image. The results are discussed, and other applications of the general technique are considered. (J.R.D.)

3125 SCL-T-209

MEASUREMENT OF FORCE PATTERN DURING BRIEF DISRUPTION OF PLASTICS THROUGH AN EXPLOSIVE DETONATION BY MEANS OF A STRAIN GAUGE STRIP (EXTENSOMETERS OR DILATOMETERS). (Die Messung des Kraftverlaufs beim kurzzeitigen Zerreissen von Kunststoffen durch eine Sprengstoffdetonation mittels Dehnungsmessstreifen). H. Käufer and W. Christmann. Translated by Marcel I. Weinreich (Sandia Corp.) from Kolloid-Z. 152, 18-23 (1957). 11p.

A disruption apparatus, with a testing rod stressed by a brief explosive detonation, is described. The apparatus contains a measuring element which permits the measurements of both the force pattern and the duration of the stress. The disruption process occurs in the time interval between 10^{-3} and 10^{-5} seconds. The investigation of different plastics shows a dependence of the tensile strength on the stress area. (A.C.)

3126 TT-778

PRACTICAL EXPERIENCE WITH THE MONITORING EQUIPMENT OF THE GERMAN METEOROLOGICAL SERVICE. (Praktische Erfahrungen mit dem Überwachungsgerät des Deutschen Wetterdienstes). F. Becker. Translated by D. A. Sinclair (National Research Council of Canada) from Beitr. Physik Atmosphäre 30, 211-14(1958). 7p.

Measurements with the Landis and Gyr (Zug, Switzerland) beta-activity monitoring equipment provide some interesting insights into the variations of the radioactive content of the atmosphere. The manner and extent to which the activity level can rise above the normal is shown, and a possible way in which meteorological processes may be involved in these variations is discussed. (auth)

3127 UCRL-Trans-372

THE THEORY OF ADSORPTION AND RELATED PHENOMENA. J. Frenkel. Translated for Univ. of Calif. Radiation Lab. from Z. Physik 26, 117-38(1924). 33p.

Theories are presented which can be applied to a series of phenomena connected with gas adsorption and the sublimation of solids. Special emphasis is placed on high-temperature reactions. Formulas are derived which support the theories presented. (C.H.)

3128

STUDY OF THE CHARGING OF BORON AND LITHIUM IN NUCLEAR EMULSIONS. V. Labău and M. Nicolae. Acad. rep. populare Romine Inst. fiz. atomica si Inst. fiz. Studii cercetari fiz. 9, 231-40(1958). (In Rumanian)

The procedure for B and Li loading of nuclear emulsions NIKFI K of 100 μ, which are to be used for neutron flux measurements, and the treatment of the loaded plates were studied. The plates were soaked for an hour at 24°C in solutions with variable concentrations of B and Li, 40 to 65 mg of B/cm^3 of solution and 0.8 to 10 mg of Li/cm^3 of solution. The pH varied between 6.6 and 6.8. The absorption curve for B and Li in these conditions was determined, and the variation of performance of the emulsion was studied as a function of the concentration. Plates were obtained containing 10 to 120 mg of B and 3.5 to 20 mg of Li/cm^3 of emulsion. The plates could be used for the relative determination of a neutron flux. A calibration with a standard source was necessary for absolute determinations. (tr-auth)

3129

AUTORADIOGRAPHIC ANALYSIS OF PLUTONIUM DEPOSITION IN HUMAN SKIN. N. L. Dockum and A. C. Case (General Electric Co., Richland, Wash. and Atomic Energy Commission, Washington). Acta Radiol. 50, 561-4(1958) Dec.

Autoradiography is recommended as a routine procedure to supplement information gained from chemical analysis and counting procedures in human skin plutonium contamination incidents where biopsies are taken. (auth)

3130

THE PROPERTIES OF THE SATURATED HELIUM FILM. L. C. Jackson and L. G. Grimes. (Univ. of Bristol, Eng.). Advances in Phys. 7, 435-78(1958) Oct.

An account is given of the known properties of the relatively thick film which covers all solid surfaces in contact with liquid helium II or with the saturated vapor in equilibrium with the liquid. The information, as yet rather meager, available on the properties of the film which exists above the λ-point also is discussed. (auth)

3131

A PRECISION COBALT 60 UNIT FOR FIXED FIELD AND ROTATION THERAPY. H. E. Johns and J. R. Cunningham (Ontario Cancer Inst., Toronto). Am. J.

Roentgenol. Radium Therapy Nuclear Med. 81, 4-12 (1959) Jan.

A new type of cobalt-60 unit has been constructed to be practical for both fixed-field and rotation therapy. The penumbra has been kept small through the use of a special collimator and adequate source-to-tumor distance. Devices for accurate beam alignment including an x-ray tube have been built into the head. A focussing ion chamber for transmission dose measurements is incorporated in the counterweight. Details of the unit are presented. (auth)

3132

RADIOACTIVE CHROMIUM 51 GAMMA RAY SOURCES. William G. Myers (Ohio State Univ., Columbus). Am. J. Roentgenol. Radium Therapy Nuclear Med. 81, 99-106 (1959) Jan.

Radioactive chromium-51 is advocated as a gamma isotope that should be eminently suitable for interstitial and other applications in radiation therapy. Presently, it is being generated in cylinders 2.5 mm long and of 0.8 mm diameter that are cut from pure chromium wire. The cylinders emit 323-kev gamma rays and decay with a half-life of 28 days. Because they emit no β particles and the soft x rays emitted incidental to electron capture are almost completely absorbed within the cylinders, they may be considered to be purely monoenergetic gamma-ray sources. (C.H.)

3133

STABLE NITROGEN ISOTOPE ANALYSIS BY OPTICAL SPECTROSCOPY. H. P. Broida and M. W. Chapman (National Bureau of Standards, Washington). Anal. Chem. 30, 2049-55(1958) Dec.

Optical spectroscopy with photo-electric detection provides a rapid and precise micromethod for determining the nitrogen isotopic concentration of nitrogen gas and of nitric oxide gas. This paper describes the effect of operating conditions on the precision and the accuracy of such measurements. A determination can be made on a sample of 20 cc at a pressure of 1.5 mm of mercury (0.04 cc-atm) in approximately 10 minutes, to an accuracy of a few per cent. (auth)

3134

USES OF RADIOISOTOPES IN THE USSR. A. V. Topchiev, I. T. Alad'ev, and P. S. Savitskii. Atomnaya Energ. 5, 321-34(1958). (In Russian)

A review is presented of the production and handling of radioisotopes in the USSR. More than 90 radioactive isotopes, 170 stable isotopes, and 360 labeled compounds are produced. Production planned for the year of 1958 is as follows: Co^{60}, over 190,000 c; C^{14}, 200 c; Pu^{32}, 1100 c; S^{35}, 900 c; I^{131}, 1200 c; Au^{198}, 1000 c; Ir^{192}, 192 c; Cs^{137}, 137 c; and Tu^{170}, 750c. 75 references. (R.V.J.)

3135

STUDY OF RADIOACTIVE STRONTIUM SORPTION ON MONTMORILLONITE AND ITS FIXATION BY CALCINATION. Vict. I. Spitsyn and V. V. Gromov. Atomnaya Energ. 5, 446-52(1958). Oct. (In Russian)

The comparative abilities of various cations to reduce the absorption of radioactive strontium are as follows: $Al^{3+} > Fe^{3+}$; $Ba^{2+} > Ca^{2+} > Mg^{2+} > H^{+} > NH_4^{+} > K^{+} > Na^{+}$. It is shown that the radioactive strontium sorption on montmorillonite is of ion-exchange nature and obeys the active mass law. The presence of CO_3^{2-}, SO_4^{2-}, and $C_2O_4^{2-}$ anions, which in combination with strontium form difficult soluble salts, does change the sorption mechanism but reduces the quantity of sorbed strontium, probably by forming radioactive colloids. The calcination at 800 to 900°C, and the increased time of calcination of over 1 to 2 hours do not influence the degree of strontium fixation; moreover, the activity carried by river or sea water is about 2%. Up to the 800°C when the alterations take place in the crystal lattice, the fixation is the result of the combination of difficultly soluble salts of strontium with the sorbent. Above 800°C the process is determined by the alterations in the crystalline lattice and slow mineral vitrification. (tr-auth)

3136

ANGULAR AND ENERGY DISTRIBUTIONS OF GAMMA-RAYS SCATTERED BY Fe AND Pb. Yu. A. Kazanskii, S. P. Belov, and E. S. Matusevich. Atomnaya Energ. 5, 457-9(1958). (In Russian)

Angular and energy distributions of γ rays scattered by Co^{60} (E = 1.33 and 1.17 Mev) and Au^{198} (E = 0.411 Mev) after passing through lead (μ_0 r = 2.2, 4.1, 6.3, 8.2; μ_0 is the coefficient of γ-ray absorption, r is the thickness of the lead or iron filter) or through iron (μ_0 r = 2, 4, 6, 8.5, and 9.8) were measured. The measurements were made in conditions of semi-infinite geometry. The distribution of the source, media, and detector as well as the basic geometrical dimensions of the apparatus are presented graphically. A scintillation spectrometer with CsI(Tl) crystal 30 mm diameter and 27 mm high, was used for measuring the radiation scattered from the media. Angular measurements were made for 10, 20, 30, 40, 50, and 60°. (R.V.J.)

3137

ON THE INFLUENCE OF RADIATION ON THE ISOTOPIC EXCHANGE RATIO. V. I. Spitsyn and I. E. Mikhailenko. Atomnaya Energ. 5, 463-4(1958). (In Russian)

The influence of S^{35} β radiation on the isotopic exchange ratio of sulfur in the $K_2SO_4-SO_3$ system at 840°C was studied. The results obtained for potassium sulfate containing variable quantities of radioactive S^{35} are tabulated. (R.V.J.)

3138

THE RESOLUTION CORRECTION IN THE SCINTILLATION SPECTROMETRY OF CONTINUOUS X RAYS. W. R. Dixon and J. H. Aitken (National Research Council, Ottawa). Can. J. Phys. 36, 1624-33(1958) Dec.

The problem of making resolution corrections in the scintillation spectrometry of continuous X rays is discussed. Analytical solutions are given to the integral equation which describes the effect of the statistical spread in pulse height. The practical necessity of making some kind of numerical analysis is pointed out. Difficulties with numerical methods arise from the fact that the observed pulse-height distribution cannot be defined precisely. As a result it is possible in practice only to find smooth "solutions." Additional difficulties arise if the numerical method is based on an invalid analytical procedure. For example matrix inversion is of doubtful value in making the resolution correction because there does not appear to be an inverse kernel for the integral equation in question. (auth)

3139

THE ROLE OF THERMAL CONDUCTIVITY IN THE FORMATION AND MAINTENANCE OF A DETONATION WAVE IN A CONDENSED EXPLOSIVE. Jean Berger, Jacques Favier, and Claude Fauquignon. Compt. rend. 247, 1305-7(1958) Oct. 27. (In French)

The thermal conductivity of a condensed explosive

receiving a shock wave was found to be of the order of 10^8 times greater than it was in normal conditions. A thermal scheme of formation and maintenance of the detonation wave in a condensed explosive was proposed, based on this fact. (tr-auth)

3140

THE ATMOSPHERIC DIFFUSION OF PARTICLES. Joseph Saissac. Compt. rend. 247, 1371-4(1958) Oct. 27. (In French)

A solution of the equation of homogeneous and anisotropic diffusion in the case of continuous emission underneath the soil is verified experimentally by a photometric method. (tr-auth)

3141

THEORETICAL STUDY OF THE PROFILE OF THE WAVE FRONT AND THE DETONATION VELOCITY OF CYLINDRICAL CASES OF SOLID EXPLOSIVE. Jean Berger, Thérèse Camion, and Christiane Perennes. Compt. rend. 247, 1433-6(1958) Nov. 3. (In French)

When the conditions permitting detonation is established in a cylindrical case of solid explosive, experiment shows that the wave velocity D_0 is an increasing function of the diameter ϕ of the cylinder. This velocity approaches the ideal velocity D_1 of the theoretical velocity of the permanent plane wave when ϕ approaches infinity. The expansion of the detonation products, variation of the detonation velocity as a function of confinement, and the wave profiles are determined. Different theories have been proposed to take into account these considerations, but none establish a strict bond between these phenomena. The idea of confinement is presented in the present study to clarify these relations. (J.S.R.)

3142

VARIATION OF THE LENGTH OF THE ABSORPTION CURVE OF THE YTTRIUM–IRON GARNET WITH THE SUBSTITUTION OF Cr^{3+}. Roger Vautier and André-Jean Berteaud. Compt. rend. 247, 1574-7(1958) Nov. 10. (In French)

Variations in the length of the absorption curve observed in yttrium garnet, in which the Cr^{3+} ions were substituted by Fe^{3+} ions, are reported. These variations can be explained by a variation of the density with the chromium content. (tr-auth)

3143

DISCRIMINATION BETWEEN THE γ CLOUDING AND CHEMICAL CLOUDING IN NUCLEAR EMULSIONS. Jacques Bermond and Maurice Schérer. Compt. rend. 247, 1580-3(1958) Nov. 10. (In French)

In the development of G_5 emulsions with amidol developer at low temperatures, a study was made to determine the optimum pH and length of development for a discrimination between gamma and chemical clouding. (tr-auth)

3144

GENERATION OF HIGH-VELOCITY PROJECTILES. Melvin A. Cook and Robert T. Keyes (Univ. of Utah, Salt Lake City). J. Appl. Phys. 29, 1651-7(1958) Dec.

A technique of controlling the shape of detonation wave fronts in high explosives by inert wave control inserts was applied to generate discrete ultrahigh-velocity pellets. Tests to determine the most suitable pellet shape as well as the optimum charge configuration are described, and velocities up to 7600 m/sec were realized for 0.95-g aluminum pellets. The mechanism whereby pellets are accelerated by "shaped" waves is discussed, and the conclusion is reached that a simple model based upon the transmission of shock from the detonation wave to the pellet is not applicable. (auth)

3145

27-DAY PERIOD VARIATIONS OF COSMIC RAY INTENSITY IN THE STRATOSPHERE. S. N. Vernov, V. F. Tulinov, and A. N. Charakhchyan (Lebedev Inst. of Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 788-91(1958) Oct. 11. (In Russian)

Results are presented of measurements made with radioprobes at 51′ latitude from July 1, 1957, to Feb. 1, 1958, and at 61′ latitude from July 1, 1957, to Oct. 1, 1957. (R.V.J.)

3146

ARC CATHODE MOVEMENT IN A MAGNETIC FIELD. A. E. Guile and P. E. Secker (Univ. of London). J. Appl. Phys. 29, 1662-7(1958) Dec.

An arc cathode spot in a transverse magnetic field may move either in the Amperian (forward) direction, or in the opposite (retrograde) direction. Experiments are described which show that forward continuous motion is caused by magnetic fields at the cathode surface, as is the case with retrograde motion, and that both of these motions depend upon the material and surface condition of the cathode. Forward cathode velocity both when continuous and when moving in a stepping process is independent of arc current over a wide range. The theories so far suggested for retrograde motion do not appear to be able to account for the dependence of retrograde cathode movement on the nature of the cathode surface. (auth)

3147

MICROWAVE METHOD FOR MEASURING PROBABILITY OF ELASTIC COLLISION OF ELECTRONS IN A GAS. Jay L. Hirshfield and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys. 29, 1749-52(1958) Dec.

A plasma in a dc magnetic field has a transverse conductivity component whose reactive part depends, as to both magnitude and sign, on the strength of the magnetic field. By measuring the value of magnetic field that is necessary for bringing this reactive part to zero—and hence removing any resonant-frequency shifts of a TE_{011} mode of a cylindrical cavity containing the plasma—determination of the probability of elastic collision of electrons in helium is obtained as a check on the method. The value of $P_m = 20 \pm 1$ cm^{-1} mm Hg^{-1} for the electrons at room temperature thus obtained agrees substantially with the value obtained by previous workers. Sources of error in the measurement are discussed. (auth)

3148

UNITARY TRIANGULARIZATION OF A NONSYMMETRIC MATRIX. Alston S. Householder (Oak Ridge National Lab., Tenn.). J. Assoc. for Computing Machinery 5, No. 4, 339-42(1958) Oct.

A method for the inversion of a nonsymmetric matrix has been in use at ORNL and has proved to be highly stable numerically but to require a rather large number of arithmetic operations, including a total of $N(N-1)/2$ square roots. This note points out that the same result can be obtained with fewer arithmetic operations, and, in particular, for inverting a square matrix of order N, at most $2(N-1)$ square roots are

required. For N > 4, this is a savings of (N-4)(N-1)/4 square roots. (T.B.A.)

3149

THE KINETICS OF THE ELECTROCHEMICAL DEPOSITION OF RADIOACTIVE IONS ON METAL SURFACES. Jochen Fahland, Günter Herrmann, and Fritz Strassmann (Univ. of Mainz). J. Inorg. & Nuclear Chem. 7, 201-9(1958) Oct. (In German)

The Nernst-Brunner equation has been applied to the electrochemical deposition of carrier-free radioactive ions on metal foils in a modified form to include decay and growth. The modified equation was shown to hold for the deposition of Bi^{212}(ThC) and Bi^{210}(RaE) on nickel foils from weak hydrochloric acid solutions under the following conditions: pure Bi^{212}, Bi^{212} in equilibrium with Pb^{212}(ThB), Bi^{212} in equilibrium with Th^{228}(RdTh), and Bi^{210} in equilibrium with Pb^{210}(RaD). Some indications of the purity of the deposited radio-bismuth are given. (auth)

3150

THE ELECTROSTATIC INTERACTION OF TWO ARBITRARY CHARGE DISTRIBUTIONS. M. E. Rose (Oak Ridge National Lab., Tenn.). J. Math. and Phys. 37, No. 3, 215-22(1958) Oct.

Certain features of the interaction energy of two non-overlapping but otherwise arbitarary charge distributions are examined. This problem arises in the study of Van der Waals interactions and in that application it is advantageous to express the energy operator as a multipole expansion. Some special results which were given in this connection by Margenau are generalized. It is found possible to express the complete interaction as a sum of coupling terms between the multipole moments describing the two charge distributions. For this purpose the algebra of irreducible tensors is employed and in so doing the interaction energy can be expressed in very simple form and a relatively simple interpretation of the result can be obtained. Finally, a comparison of this result with that conventionally employed permits the deduction of an interesting type of addition (or displacement) theorem for solid spherical harmonics. (auth)

3151

A THEORY FOR ESTIMATION OF INTERFACIAL ENERGIES. II. APPLICATION TO SURFACE THERMODYNAMICS OF TEFLON AND GRAPHITE. Robert J. Good, Louis A. Girifalco, and Gerard Kraus (Univ. of Cincinnati). J. Phys. Chem. 62, 1418-21(1958) Nov.

A theory previously proposed for the estimation of interfacial energies is extended to cover the calculation of the surface energy of solids from heats of immersion. For Teflon, the total surface energy is estimated to be between 56 and 69 ergs/cm^2, and the surface entropy, 0.17 erg/deg/cm^2. For graphite, the total surface energy is estimated to be 119 ergs/cm^2, the surface free energy 70 ergs/cm^2, and the surface entropy 0.16 erg/cm^2/deg. (auth)

3152

TRANSISTOR EFFECTS OF MECHANICAL DEFORMATIONS ON THE ELECTRIC CONDUCTIVITY OF LITHIUM FLUORIDE AND ALKALINE HALOGENIDES. H. Curien and Z. Mihailovic (Laboratoire de Minéralogie-Cristallographie de la Faculté des Sciences, Paris). J. phys. radium 19, 794-6(1958) Oct. (In French)

The transitory phenomena observed in crystals of alkaline halides during deformation are reported. The crystals are placed between two electrodes, and the deformation is caused by a sharp point depressing the crystal near one of the electrodes. In the absence of all deformation, a thermoelectric current is observed. The application of a deformation causes a sharp decrease in the current in LiF and KCl crystals. This decrease disappears in a few minutes. The same experiment made with the application of an external voltage also showed a decrease in current. (J.S.R.)

3153

DISTURBANCE PHENOMENA IN PROBE MEASUREMENT OF IONIZED GASES. Takayoshi Okuda and Kenzo Yamamoto (Univ. of Nagoya, Japan). J. Phys. Soc. Japan 13, 1212-23(1958) Oct.

This paper is concerned with disturbance phenomena occurring when a probe is immersed in plasma. There are two types of disturbance, i.e., one independent of probe potential and one which depends upon it. The former (inherent) disturbance has three effects: asymmetrical effect, formation effect of transition region, and the scattering effect. The latter (incidental) depends on either the negative probe or the positive probe. In the negative probe, penetration of ion sheath into surrounding plasma is characteristic. In the positive probe, there is an unexpected change of electron current, as a result of drainage of electrons, which is observed with rise of positive probe voltage. The mechanism of collection of ions and electrons on the probe is also explained in terms of these disturbance effects. (auth)

3154

MAGNETO-HYDRODYNAMIC OSCILLATIONS OF A PERFECTLY CONDUCTING FLUID SPHERE PLACED IN A UNIFORM MAGNETIC FIELD. Tsuneji Rikitake (Tokyo Univ.). J. Phys. Soc. Japan 13, 1224-30(1958) Oct.

An attempt to improve theories of magneto-hydrodynamic oscillations of a conducting fluid sphere in a uniform magnetic field is made. Unlike the previous theories which have been developed, analytical expressions for zonal oscillations are obtained. It turns out that no eigen-periods are determined accurately. However, they are approximately obtained with drastic simplifications. Two fundamental normal modes of oscillation are also approximately obtained and illustrated. (auth)

3155

ATTENUATION COEFFICIENTS FOR GAMMA RAYS FROM Co^{60}. K. Sita Rama Sastry and Swami Jnanananda (Andhra Univ., Waltair). J. Sci. Ind. Research (India) 17B, 389-94(1958) Oct.

Attenuation coefficients in seven different alloys and in Perspex for the 1.1715 and 1.3316 Mev gamma radiations from a 17 mc Co^{60} source have been estimated by the method of least squares, employing the narrow beam geometry of Davisson and Evans with provision for accurate collimation. The experimental values for the coefficients and the theoretical values, expected from the additive law of mass absorption coefficients, agree within 0.25 to 1.2 per cent. Effective atomic numbers for the total interaction and the three partial effects (photoelectric effect, Compton scattering, and pair production) have been obtained for two tungsten steels, sodium iodide, and phosphor bronze by interpolation. The results indicate the necessity of different effective

atomic numbers to describe the various types of gamma-ray interaction in a mixture of elements. (auth)

3156

DEPENDENCE OF THE NUCLEONIC COMPONENT OF COSMIC RAY AIR SHOWERS ON RADIUS. C. S. Wallace, M. M. Winn, and K. W. Ogilvie (Univ. of Sydney). Nature 182, 1653-4(1958) Dec. 13.

An air shower apparatus is described which can be used to find the size of showers falling within its sensitive area with an accuracy of ± 4 m. The direction of approach can also be obtained. The nucleons are detected by use of a neutron monitor, which is arranged so that the neutrons in each event are recorded. A total of 3,113 showers was observed between June 1957 and May 1958. The results of these experiments are discussed and presented in tables and graphs. (J.R.D.)

3157

THE NUCLEON EFFECTIVE MASS AND THE STATISTICAL MODEL OF THE NUCLEUS. E. Clementel (Istituto di Fisica dell'Universita, Ferrara and Istituto Nazionale di Fisica Nucleare, Padua) and C. Villi (Istituto di Fisica dell'Universita, Trieste and Istituto Nazionale di Fisica Nucleare, Trieste). Nuovo cimento (10) 9, 950-89(1958) Sept. 16.

The statistical model of the nucleus has been refined taking into account the momentum dependence of the real part of the nucleon-nucleus potential. The promising features of this model are discussed with special regard to the concept of the nucleon effective mass. The determination of the nucleon effective mass is carried out taking into account separately the experimental value of the symmetry energy and of the nuclear level density observed in slow neutron capture experiments. (auth)

3158

THE POLARIZATION OF COSMIC RAY MUONS. J. M. Fowler, H. Primakoff, and R. D. Sard (Washington Univ., St. Louis). Nuovo cimento (10) 9, 1027-45(1958) Sept. 16.

Cosmic-rays muons of definite energy and direction of motion are expected to show a partial longitudinal polarization because of the falling energy spectrum of the parent pions. The general theory of muon polarization in $\pi \to \mu$ decay in flight is worked out, and applied to cyclotron as well as cosmic-ray experiments. Cosmic-ray muons are predicted to have a partial longitudinal polarization of about 23%. The theory is also applied to the $K \to \mu$ decay. An experiment has been carried out to test the prediction for cosmic-ray muons. Decay electrons from muons stopped in an aluminum absorber are detected in identical scintillation counters placed symmetrically above and below the absorber. The delay and amplitude of each observed pulse have been measured, and used to sort out the $\mu^+ \to e^+$ decays from the $\mu^- \to e^-$ and background contributions. The ratio of $\mu^+ \to e^+$ events detected in the upper and lower scintillators is 1.14 ± 0.07, as compared with a theoretical prediction of about 1.11. To test the symmetry of the apparatus the experiment has also been carried out with an absorber of salt, which is known to depolarize stopped muons almost completely. The upper to lower ratio is in this case 1.03 ± 0.06, to be compared with the theoretically expected value of about 1.02. It is concluded that the various assumptions made in the theory of muon polarization in $\pi \to \mu$ decay in flight are correct and that muons suffer negligible depolarization while losing 2 Bev energy in the atmosphere. (auth)

3159

HYPERFRAGMENT BINDING ENERGIES. S. Limentani, P. E. Schlein, P. H. Steinberg, and J. H. Roberts (Northwestern Univ., Evanston, Ill.). Nuovo cimento (10) 9, 1046-53(1958) Sept. 16.

A study of hyperfragments has been made in a 10-inch^3 stack of Ilford G5 emulsion which was exposed to the Berkeley 4.7 Bev/c π beam. In area scanning 66,500 interaction stars, 37 hyperfragments (12 mesonic decays—25 non-mesonic decays) and 61 other secondary events (GOKS) with connecting tracks < 15 μm were found. Some fraction of these 61 GOKS (undetermined in this study) represent hyperfragments. Binding energies for 6 of the mesonic hyperfragments have been obtained. Three of these binding energies are for $Z \geq 3$. (auth)

3160

ON THE FORMATION OF MAGNETO-HYDRODYNAMIC SHOCK WAVES. S. Segre (Univ. of Rome). Nuovo cimento (10) 9, 1054-7(1958) Sept. 16.

A solution of the time-dependent non-linear equations of magneto-hydrodynamics for the propagation of plane (finite) waves is discussed, for a simple case in which there is a strong analogy with hydrodynamics. (auth)

3161

ANGULAR DISTRIBUTION IN $\pi-\mu$ DECAY. P. Connolly and G. Lynch (Cornell Univ., Ithaca, N. Y.). Nuovo cimento (10) 9, 1077-81(1958) Sept. 16.

Analysis has been made of the decays of 5,034 photo-produced π^+ mesons stopping in nuclear emulsion. The angular distribution consistent with isotropy. (auth)

3162

NOTE ON THE ELECTRON CAPTURE DECAY OF $^{121}Te^m$. R. K. Gupta, S. Jha, and B. K. Madan (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 9, 1117(1958) Sept. 16.

Pure tellurium was chemically separated from a sample of deuteron-irradiated metallic antimony. The γ-ray spectrum of the tellurium fraction was studied in a scintillation spectrometer for a period of over eight weeks. It was found that whereas the 575 kev γ-ray activity decayed with a half life of about 17 days, the 1130 kev γ-ray intensity decayed with a much longer half life. An examination of the systematics of the occurrence of the $d_{5/2}$ and the $g_{7/2}$ levels in the isotopes of Sb, Te, and I shows that a $g_{7/2}$ level in Sb^{121} should lie a little above the ground state $d_{5/2}$ level. It seems that the 70 kev γ ray found in the decay of Te^{121} arises from a level at about 70 kev above the ground state. Results indicate that these studies are not inconsistent with the assumption that the 506 kev γ-ray originates in a transition from the 575 kev to the 70 kev level. It was found that the log ft value is about 8 for the decay energy involved in the 5% electron capture decay branching of Te^{121}. (J.H.M.)

3163

HIGH FREQUENCY ION SOURCES (REVIEW). A. N. Serbinov and V. I. Petrov. Pribory i Tekh. Eksp. No. 5, 3-16(1958) Sept. (In Russian)

Physical principles of high-frequency ion sources and construction of high-frequency apparatuses used in high-voltage accelerators are described. (R.V.J.)

3164

TEMPERATURE MEASUREMENTS OF SHOCK WAVES BY THE SPECTRUM-LINE REVERSAL METHOD. J. G. Clouston, A. G. Gaydon, and I. I. Glass (Imperial Coll., London). Proc. Roy. Soc. (London) A248, 429-44 (1958) Dec. 9.

By using a photomultiplier and cathode-ray oscillograph responsive only to changes in light signal, the sodium-line reversal technique, commonly used for measurement of flame temperature, has been adapted for time-resolved studies of temperature behind shock waves produced by a bursting diaphragm. The sensitivity of the method is discussed; temperatures can be determined to about ±30°C. General agreement between calculated and observed temperatures is obtained, but both air and oxygen show a high-temperature region due to burning at the interface with the hydrogen driver gas. In nitrogen at around 2400°K, a low-temperature region close to the shock front may be attributed to a vibrational energy lag of the order of 100 μs, the sodium excitation following the effective vibrational temperature rather than the translational temperature of the nitrogen. In oxygen, evidence for a dissociation relaxation effect is obtained for shocks giving temperatures of around 2500°K; this produces an abnormally high temperature near the front. Other irregularities in temperature in the uniform flow region, especially for nitrogen, are discussed. The period of uniform flow is only about half that expected for a real inviscid gas. (auth)

3165

RELATIVISTIC MAGNETOHYDRODYNAMICS. Ken-iti Goto (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 20, 1-14(1958) July.

Starting with the relativistic Boltzmann transport equation, basic equations for relativistic magnetohydrodynamics of perfect and imperfect gases are derived. Relativistic magnetohydrodynamical generalizations of Kelvin's circulation theorem, Helmholtz's vortex theorem, and Rankine-Hugoniot's shock relations for the simple gas are also given. (auth)

3166

LOW ENERGY ELECTRON-HYDROGEN SCATTERING. Takashi Ohmura, Yasuo Hara, and Takahiko Yamanouchi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 82-8(1958) July.

The effective range theory is developed for electron-hydrogen scattering. The scattering length a_s and the effective range r_{0s} of the singlet state are determined by making use of the accurate solution of the H^- ion state, as $a_s = 7.03$, $r_{0s} = 3.37$ (in atomic unit). The scattering length a_t and the effective range r_{0t} of the triplet state are calculated from the zero energy solution by a variation-perturbation method. The results are $a_t = 2.34$, $r_{0t} = 1.29$. (auth)

3167

STELLAR SYNTHESES OF THE α-PARTICLE NUCLEI HEAVIER THAN Ne^{20}. Chushiro Hayashi, Minoru Nishida, Noboru Ohyama, and Hiroshi Tsuda (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 20, 110-12(1958) July.

To explain the cosmic abundance of α-particle nuclei, the so-called α-process has been proposed. The first and most important reaction in this process is $Ne^{20}(\gamma,\alpha)O^{16}$. The stellar conditions, i.e., temperature, density and duration of time, necessary to explain the observed abundances of α-particle nuclei by the above process are investigated. (A.C.)

3168

AN EXAMPLE OF ONE-DIMENSIONAL OSCILLATORY MOTION IN MAGNETOHYDRODYNAMICS. Nobumichi Mugibayashi (Kobe Univ.). Progr. Theoret. Phys. (Kyoto) 20, 241-3(1958) Aug.

An analysis is made of one-dimensional oscillations of a highly conductive medium caused by some external force. A set of particular solutions of the basic equations in one dimension has been found. A peculiar feature of magnetohydrodynamics is found: that the moving region of the medium can be adjacent to the motionless part. (A.C.)

3169

DOSIMETRY FROM A Ru^{106}-COATED PLATINUM PELLET. Bernard Altshuler (New York Univ.-Bellevue Medical Center). Radiation Research 9, 626-32(1958) Dec.

The implantation in tissue of a platinum pellet coated with Ru^{106} presents a special case for determining dosage from a localized β-ray source placed in an inhomogeneous medium at the boundary between low- and high-density media. A method for calculating an approximate dose distribution is given which applies the function describing the radial distribution of dose from a point source in a homogeneous medium; the pellet is treated as a reflector, and a simple assessment of angular scattering in the tissue suffices for the approximation. (auth)

3170

AVERAGE ENERGY EXPENDITURE PER ION PAIR IN GASES AND GAS MIXTURES. J. M. Valentine (Western Regional Hospital Board, Glasgow) and S. C. Curran (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Repts. Progr. in Phys. 21, 1-29(1958).

Theoretical and experimental work on the evaluation of w, the average energy expenditure per ion pair, in various gases and gas mixtures is reviewed. Ionization by electrons, α-particles, protons and heavy particles is discussed. (auth)

3171

ABSORPTION AND FLUORESCENCE SPECTRA OF IONS IN CRYSTALS. W. A. Runciman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Repts. Progr. in Phys. 21, 30-58(1958).

The absorption and fluorescence spectra provide direct information about the energy levels of the ions in a crystal. Alternatively, the ions may be regarded as probes measuring the crystalline field. The introduction deals with the influence of the crystal on the energy levels of the free ions. After a brief description of the experimental techniques, which include measurements down to 1°K, the various ion groups are considered in detail. Ions of the 3d group are often in approximately octahedral surroundings, and the spectra of such complex ions are described. Then the 4d and 5d groups are discussed. The theory of the spectra of rare-earth salts is reviewed with special reference to polarization and Zeeman effects, and the individual ions are considered. Lastly there are two sections devoted to the heavy metal ions, including thallium, and to uranium and the transuranics, which are of interest because of the importance of the 5f electrons in the interpretation of the spectra. (auth)

3172

ELECTROMAGNETIC EXCITATION OF NUCLEI BY NUCLEAR PROJECTILES AND ELECTRONS. R. Huby (Univ. of Liverpool). Repts. Progr. in Phys. 21, 59-111(1958).

The principles of the excitation of nuclei by their electromagnetic interaction with bombarding particles are developed in §§ 1–4 in a common way for electrons and nuclear projectiles. Thereafter these two types of

projectile are dealt with separately, first as regards theory and then the experimental method. (auth)

3173

THE THEORY OF COLLECTIVE EXCITATIONS IN NUCLEI. D. M. Brink (Clarendon Lab., Oxford). Repts. Progr. in Phys. 21, 144-64(1958).

In some regions of the periodic table nuclei show an energy spectrum characteristic of a rotator and appear to have a non-spherical equilibrium shape. Such nuclei have been described successfully by a unified model which exhibits both collective and individual particle aspects of nuclear structure. The model ascribes wave functions to the low nuclear states which are products of collective wave functions, representing the rotation of the nuclear deformation, with wave functions representing the intrinsic motion of nucleons inside the nucleus. Sequences of levels showing the rotational spectrum correspond to states with the same intrinsic wave function, but with different collective motions. The rotational wave functions are represented by rotation matrices, and the collective motion is closely analogous to the quantum mechanical rotations of a symmetric top with moment of inertia about half that of an equivalent rigid body. The intrinsic state is approximated by a Hartree-Fock type wave function, with the individual particle orbitals defined by a deformed potential determined by the nuclear shape. Magnetic dipole and electric quadrupole moments are given by the corresponding intrinsic moments modified by a projection factor depending upon the mode of collective rotation. Hence the intrinsic deformation of the nuclear charge gives rise to large electric quadrupole moments. Within a rotational sequence, electromagnetic transition probabilities depend on the intrinsic electric or magnetic moments and on the rotational modes of the initial and final states. Between rotational sequences, where the intrinsic particle state changes, the transition probabilities depend on an 'intrinsic transition probability' modified by parameters determined uniquely by the collective motion. Other nuclei show an energy spectrum of a type which can be associated with a vibration of the nuclear surface. (auth)

3174

FOURIER METHODS IN STRUCTURE ANALYSIS BY ELECTRON DIFFRACTION. J. M. Cowley and A. L. G. Rees (Commonwealth Scientific and Industrial Research Organization, Melbourne). Repts. Progr. in Phys. 21, 165-225(1958).

The various methods of deducing the structure of crystals from electron diffraction data are reviewed. A rational and uniform nomenclature is proposed in an effort to resolve the present confusion. A critical review of the theory of electron scattering, including discussion of the nature of the approximations, is given. The application of Fourier methods to the analysis of crystal structure from both diffraction intensities and fine structure of dynamic origin is outlined and illustrated for polycrystalline and single-crystal specimens. Some remarks are made on the possibilities of direct observation of crystal structure by electron-optical methods. (auth)

3175

THE SPECIFIC HEATS OF METALS AT LOW TEMPERATURES. D. H. Parkinson (Royal Radar Establishment, Great Malvern, Worcestershire, Eng.). Repts. Progr. in Phys. 21, 226-70(1958).

The specific heats of metals at low temperatures have been studied extensively both theoretically and experimentally. There are many processes which contribute to the specific heat, most of them simultaneously which makes the experimental determination of any one difficult. The specific heat is insensitive to the 'finer structure' of matter and so is of limited value on its own in assessing the refinements of theory. Nevertheless its calculation requires the minimum of theory and it is the 'basic parameter' which must be given by any general theory describing the energy levels of a crystal. The contribution due to the excitation of the lattice vibrations is usually represented in terms of θ_D, the Debye characteristic temperature. There have been several attempts to calculate the lattice contribution to the specific heat for metals. In such calculations the chief difficulty is to take account of the effect of the free electron gas on the elastic constants. The free electrons themselves contribute a term which is linear with temperature and which can be observed at temperatures of a few degrees only. Band theory gives a qualitative description of the behavior of the free electrons in metals but for the complex metals apart from aluminum the quantitative description is vague. The general properties of the transition metals can be explained using the idea of a d-band in which there is a comparatively high density of states and for which the density of states at the Fermi-level can be estimated from the linear 'electronic' term in the specific heat. With superconductors the thermodynamic equations governing the transition yield expressions for the free electronic specific heat in the normal state which depend on magnetic parameters only. This gives a convenient way of determining the electronic specific heat but one which is difficult to apply as it requires strain-free specimens of the highest purity. Recently it has been shown that in the superconducting state the specific heat follows an exponential law rather than a cubic with temperature as was originally believed. The rare earth metals show a great number of spectacular anomalies of magnetic origin in their specific heat curves and include both ferro- and antiferromagnetism. There has been no general theoretical attempt to explain their complex behavior. Experimentally specific heats are difficult to determine with precision and although thermal isolation can be achieved comparatively easily there are many sources of error. Below 1°K there has been little systematic work and much remains to be done. (auth)

3176

PRODUCTION AND MEASUREMENT OF HIGH TEMPERATURES. W. Lochte-Holtgreven (Kiel Univ.) and R. Schall and F. Wecken. Repts. Progr. in Phys. 21, 321-83(1958).

Information is presented on the study of thermally excited plasmas with temperatures in the range of 10,000-70,000°K. In case of no self-absorption the measurement of these temperatures can be effected by observation of lines or of continuous radiation emitted from the plasma. The study of lines implies both line intensities and line shapes. Following the discussion of the different methods of evaluating temperatures the specific properties of a plasma—viscosity, electrical and heat conductivity—are touched upon. The production of high temperatures are dealt with. Arcs, pulsed discharges and sparks, exploding wires and shock waves, and finally chemical reactions are discussed.

The temperatures actually obtained, the practical applications, and the limitations of the different approaches are indicated. (auth)

3177

DETERMINATION OF CARRIER CONCENTRATION AND MOBILITY IN GERMANIUM FROM HALL EFFECT DATA. R. M. Vinetskii and E. G. Miselyuk (Inst. of Physics, Academy of Sciences, Ukrainian SSR.). Ukrain. Fiz. Zhur. 3, 230-1(1958) Mar.-Apr. (In Ukrainian)

The validity range of elementary formulas for calculation of current carrier concentration and mobility in germanium from Hall effect and conductivity measurements is established in this paper. A curve is plotted for the quantitative estimation of errors due to the application of these formulas in different cases. (tr-auth)

3178

THERMAL EXPANSION OF VACUUM DEFORMED NICKEL. S. D. Gertsriken and N. N. Novikov (Shevchenko Kiev State Univ.). Ukrain. Fiz. Zhur. 3, 274-6(1958) Mar.-Apr. (In Ukrainian)

The thermal expansion of vacuum and technical nickel at 20 to 700°C under compression was studied. A strong expansion was first observed at 80 to 200°C, the next at 350 to 500°C. The last and final expansion took place at 550 to 600°C. The magnitudes of relative volume changes in nickel under deformation forces are presented graphically. (R.V.J.)

3179

THE ELECTRICAL AND MAGNETIC EFFECT ON THE HYDROGEN H_β LINE IN PERPENDICULAR CROSSED FIELDS. W. Steubing and F. Lebowsky (Physikalische Staatsintitut, Hamburg). Z. Physik 153, 64-95(1958). (In German)

The splitting of the hydrogen H_β line was investigated in a magnetic field with the simultaneous action of an electric field perpendicular to it. By means of the Schrödinger perturbation calculations, the pattern of the splitting as well as the line intensities in the combined fields were calculated. Apart from the absolute magnitudes, the splitting image depends only on the ratio of both fields. Going from the pure Zeeman effect (F = O), the effect of the electric field is scarcely noticeable. After a transition range, in which both fields exert equal influences, the effect of the magnetic fields disappears until only the pure Stark effect remains. These three ranges pass continuously into each other. The experiments which confirm the calculated pattern of the splitting within the measuring accuracy are described. The observed intensity ratios of the components show no disagreement with the calculated values. (tr-auth)

3180

ON THE DISTRIBUTION OF NUCLEON DENSITY IN NUCLEI. F. I. Kligman. Zhur. Eksptl'. i Teoret. Fiz. 35, 367-71(1958) Aug. (In Russian)

The distribution of orbital momenta in nuclei is considered on the basis of the statistical nuclear model with the use of various distribution functions of nucleon density. It is shown that reasonable nucleon density distribution functions can be chosen which satisfy the experiments on scattering of fast electrons by nuclei, the condition of saturation of nuclear forces, and the fundamental requirements of the shell nuclear model. (tr-auth)

3181

ON THE TEMPERATURE OF THE ELECTRONS IN A PLASMA IN A VARIABLE ELECTRIC FIELD. A. V. Gurevich (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 392-400(1958) Aug. (In Russian)

The heating of electrons in a plasma in a variable electric field is considered. It is shown that the electron gas can exist in two stable states with different temperatures; transition from one state to another occurs at certain critical values of the amplitude and is accompanied by an appreciable change in the electron temperature. A peculiar type of hysteresis in the dependence of the electron temperature on the amplitude and frequency exists. The influence of a constant magnetic field on this effect is also taken into account. An expression was obtained for the complex conductivity of a plasma in a varying electric and constant magnetic fields (with account of collisions between the electrons). (tr-auth)

3182

PHENOMENOLOGICAL THEORY OF SUPERFLUIDITY NEAR THE λ-POINT. L. P. Pitsevskii (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 408-15(1958) Aug. (In Russian)

A complete set of phenomenological equations is derived which describes the behavior of superfluid helium near the λ point. The normal part of the liquid is described in the usual manner whereas the superfluid part is described by an effective wave function. (tr-auth)

3183

DEPOLARIZATION OF ELECTRONS DUE TO MAGNETIC FIELD EMISSION. Yu. F. Orlov and S. A. Kheifets (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 513-14(1958) Aug. (In Russian)

The magnitude of depolarization induced by secondary emission in magnetic fields is evaluated. The wave functions are used for calculations of the emission probability with the spin turn-over in homogeneous magnetic fields. (R.V.J.)

3184

FORMATION OF TWO TEMPERATURES IN IONIZED GAS IN MAGNETIC FIELD. E. Larish and I. Shekhtman (Inst. of Applied Mechanics, Bukharest). Zhur. Eksptl'. i Teoret. Fiz. 35, 514-15(1958) Aug. (In Russian)

Calculations indicate that the temperature difference in ion and electron gas components can reach considerable magnitudes. (R.V.J.)

3185

CALCULATION OF THE PHYSICAL DOSAGE OF γ-IRRADIATION. II. THE DOSAGE INTENSITY FROM A FLAT AND A TRI-DIMENSIONAL SOURCE. I. A. Kalinin and P. Ya. Vertebnyi. Zhur. Fiz. Khim. 32, 2192-8(1958) Sept. (In Russian)

Based on the approximate account of the scattering of gamma quanta in air and in various materials, a number of formulas are derived for calculation of the dosage intensity from flat and tri-dimensional sources, depending upon the energy of the gamma radiation, the surface or bulk concentration, and the distances from the sources and their sizes. Nomograms were plotted of the formulas for the dosage intensity over the center and at the boundary of a round plane source, from a round cylinder at various distances, and also from the surface of a cylinder or a sphere. The nomograms permit of the solution of a number of inverse problems. (tr-auth)

3186

ON THE THEORY OF ION-ELECTRON EMISSION FROM METALS. II. COMPARISON WITH EXPERIMENT. S. V. Izmailov. Zhur. Tekh. Fiz. 28, 2209-16 (1958) Oct. (In Russian)

Results of experiments were correlated with the radiation theory of electron extraction from the metal by fast positive ions. It is shown that the experiments are in good agreement with the theory. It is stressed that for detailed comparisons and further development of the theory a complex study of secondary electron emission is imperative. (tr-auth)

3187

THEORY OF INELASTIC SCATTERING OF ELECTRONS IN METALS. I. A. Ya. Vyatskin. Zhur. Tekh. Fiz. 28, 2217-27(1958) Oct. (In Russian)

The problem of inelastic scattering of non-relativistic electrons in metals by Coulomb interactions with electron lattices was studied. The problem is resolved as a sequence of single-electron approximations of a weak bond in an electron lattice. (R.V.J.)

3188

PHOTOCONDUCTIVITY EXCITATION AND LUMINESCENCE SPECTRA OF CdS CRYSTALS. V. L. Broude, V. V. Eremenko, and V. S. Medvedev. Zhur. Tekh. Fiz. 28, 2263-5(1958) Oct. (In Russian)

It was shown that there is a close connection between the photoconductivity of CdS crystals and their green luminescence. For some specimens the excitation spectra coincide. The spectral distribution of the quantum yield, which in contrast to the spectral distribution of photocurrent is not complicated by the dependence of free electron lifetimes on the wavelength, is close to the green luminescence excitation spectra. Two types of orange luminescence excitation were observed which indicate the presence of two luminescences of different origin. In some crystals the orange luminescence is accompanied by green and is induced by absorption in the 20,600 to 20,700 cm^{-1} region. Other specimens with strong orange luminescence have a supplementary long wave band of absorption. (R.V.J.)

3189

INVESTIGATION OF A HIGH-FREQUENCY RESONANCE DISCHARGE. A. A. Glazov and D. L. Novikov. Zhur. Tekh. Fiz. 28, 2295-2301(1958) Oct. (In Russian)

Descriptions are given of a high-frequency resonance discharge in a magnetic field at frequencies of 50 to 100 hertz. Analysis is made of the theoretical and experimental breakdown conditions, and characteristics and properties of gas discharge plasma are investigated. (R.V.J.)

3190

ON THE RESOLVING POWER OF THE SO-CALLED "HIGH-DISPERSION" X-RAY PHOTOGRAPHY. B. Ya. Pines, A. F. Sirenko, and L. G. Melnik. Zhur. Tekh. Fiz. 28, 2344-7(1958) Oct. (In Russian)

A comparative study is made of the resolving properties in reverse exposure related to the film-specimen distance. With an increased distance between the film and specimen (D) from 90 to 750 mm the resolving power on the x-ray photograph does not increase. However, an increase over 100 to 150 mm is not efficient because with the retained resolving property, at large D, a stronger negative effect of x-ray scattering in the air appears (increased background caused by the length of the exposure). (R.V.J.)

3191

EINFÜHRUNG IN DIE MESSTECHNIK DER KERNSTRAHLUNG UND DIE ANWENDUNG DER RADIOISOTOPE (Introduction to the Measuring Techniques of Nuclear Radiation and the Application of Radioisotopes). Heinrich Fassbender. Stuttgart, Georg Thieme Verlag, 1958. 232p.

An introduction to the measurement of nuclear radiations is presented for the use of doctors, scientists, engineers, and students. A brief introductory section gives the atomic physical fundamentals for radiation detection and measurement. The measuring techniques used for nuclear radiation are described. The application of radioisotopes and radiation measuring instruments to biology, x-ray analysis, chemistry, technology, and other fields is illustrated with many examples. The last section of the book discusses radiation protection. 72 references. (J.S.R.)

3192

LOW TEMPERATURE PHYSICS & CHEMISTRY. PROCEEDINGS OF THE FIFTH INTERNATIONAL CONFERENCE ON LOW TEMPERATURE PHYSICS AND CHEMISTRY HELD AT THE UNIVERSITY OF WISCONSIN, MADISON, WISCONSIN, AUGUST 26-31, 1957. Joseph R. Dillinger, ed. Madison, Wisc., The University of Wisconsin Press, 1958. 697p. $6.00

The viscosity and flow properties of liquid He^4 are presented. Heat flow and specific heat of liquid He^4 are given. The dielectric constant, refractive index, film thickness, and rotation of liquid He^4 are given. Heat diffraction, sound transmission, and structure of He^4 are presented. The theory of liquid He^4 and liquid He^3 is presented. Theories of superconductivity are presented. The properties of some superconductors are given. The superconductivity of thin films, contact resistance pressure effects, and volume changes in superconductivity are discussed. Millimeter wave absorption and the paramagnetic effects in superconductors are presented. The thermal and electrical conductivity of elements and compounds are discussed. The thermal and electrical conductivity of alloys are given. Measurements of specific heats of some solid compounds are given. De Haas–Van Alphen and other oscillatory effects are discussed. Magnetoresistance, thermoelectricity, resistivity, and Hall effect are discussed. The mechanical properties of solids including solidified gases are presented. Paramagnetism, resonances, and magnetic susceptibilities are discussed. Ferromagnetism and general magnetic properties of some compounds are given. Thermal expansion, absorption spectra, dielectric properties, rotational transitions, polymers, and nuclear magnetic resonance are discussed. Some nuclear orientation experiments are given. (W.L.H.)

3193

PREPARATION, MAINTENANCE, AND APPLICATION OF STANDARDS OF RADIOACTIVITY. National Bureau of Standards Circular 594. W. B. Mann and H. H. Seliger. Washington, National Bureau of Standards, 1958. 59p. Available from U. S. Government Printing Office, Washington for $0.35.

The methods available for the preparation and maintenance of primary and secondary standards of radioactivity are reviewed. The applications of such standards to problems in physics are discussed. 204 references. (auth)

3194

REPORTS ON PROGRESS IN PHYSICS. VOLUME XXI,

1958. A. C. Strickland. London, The Physical Society, 1958. 386p.

Information is presented on the following: average energy expenditure per ion pair in gases and gas mixtures, absorption and fluoresence spectra of ions in crystals, electromagnetic excitation of nuclei by nuclear projectiles and electrons, physics of nerve processes, the theory of collective excitations in nuclei, Fourier methods in structure analysis by electron diffraction, the specific heats of metals at low temperatures, mesonic atoms, and production and measurement of high temperatures. (J.H.M.)

3195

SEMICONDUCTOR THERMOELEMENTS AND THERMOELECTRIC COOLING. A. F. Ioffe. Translation of Poluprovodnikovye Termoelementy and Termoelektricheskoe Okhlazhdenie. London, Infosearch Limited, 1957. 189p.

Investigations on the processes of thermal and electrical conduction in semiconductors are reported. The core of the first part of the book is the second chapter on thermoelectric generators. The introductory first chapter and the supplementary third chapter present, in an abbreviated form, published information facilitating understanding of the problem of semiconductor thermoelements or describe new applications which have not yet been put in practice. In the second part of the book on thermoelectric cooling, the current state of the problem is outlined. The theory is discussed, the experimental investigations are described, and applications are given. (J.S.R.)

Elementary Particles

3196 NP-7043

Minnesota. Univ., Minneapolis.

ANGULAR CORRELATION IN THE DECAY OF PIONS AND MUONS. C. M. G. Lattes. May 19, 1958. 31p. (Notas de Física Vol. IV, No. 8).

3197 NP-7045

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

NOTE ON LEPTONIC DECAY OF PION. Prem Prakash. July 16, 1958. 5p. (Notas de Física Vol. IV, No. 11).

A universal vector–axial vector Fermi interaction has been proposed to explain experiments in β decay and μ decay. In this theory, with the lepton pair interacting at the same point in space-time, the ratio of the two modes of decay is found to be 1.36×10^{-4}. This ratio is larger by a factor of ten than that from the experimental observations and presents a serious difficulty for the local V-A theory. It is shown that in order to explain the discrepancy, it seems necessary to introduce in the Fermi interaction a term which is essentially different in structure from that involved in V-A theory. (A.C.)

3198 NP-7054

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

THE SIMULATING OF MULTIPLE PRODUCTION PROCESS. G. I. Kopylov. 1958. 18p.

An idea of constructing the "table of random stars" capable of reproducing the theoretical concepts about the multiple production of elementary particles in the form suitable for comparing with experiments is discussed. The possibility of making such a table in the energy range up to 10 Bev is shown. (auth)

3199 NP-7056

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

PROPERTIES OF CHARGE SYMMETRY AND REPRESENTATIONS OF THE EXTENDED LORENTZ GROUP IN THE THEORY OF ELEMENTARY PARTICLES. V. I. Ogievetskii (Ogievetsky) and Chou Kuang-chao. 1958. 13p.

The extended Lorentz group, involving the full Lorentz group, and the operation of charge conjugation is discussed. It is shown that the use of irreducible projective representations of this extended group requires the existence of charge multiples. Charge symmetry and associated production of strange particles follow from the invariance under reflections, charge conjugation, and the laws of conservation of electrical and baryon charges. For free nucleons there exists the Pauli-Gürsey transformation. The requirement of the invariance under this transformation in interaction leads to the isobaric invariance for all the particles in strong interactions. (auth)

3200 NP-7057

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON PROOF OF DISPERSION RELATIONS FOR INELASTIC SCATTERING. A. A. Logunov and I. T. Todorov. 1958. 17p.

A derivation of the dispersion relations for the inelastic process $p + \pi \rightarrow p' + \pi' + \pi''$ is presented, a theorem of analytical continuation being assumed. The one-nucleon states are connected with the amplitudes of simpler processes. (auth)

3201 NP-7058

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

INVESTIGATIONS OF THE REACTIONS pp–pp AND pn–pn. (Report at the 4th Session of the Joint Institute Scientific Council, May 1958). A. F. Dunaitsev and Yu. D. Prokoshkin. 1958. 17p.

Neutral pion production in nucleon-nucleon collisions at 670 Mev and at lower energies was investigated. The experiments were devoted mainly to the analysis of the angular distribution of π^0 mesons in the reactions $p + p \rightarrow p + p + \pi^0$ and $p + n \rightarrow p + n + \pi^0$. Data on the angular distributions of π^0 mesons were obtained by measuring the angular dependence of the yield of γ rays emitted in π^0-meson decay. (A.C.)

3202 NP-7059

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON THE DETERMINATION OF THE PARITY OF HYPERONS AND K-MESONS. S. M. Bilenky and R. M. Ryndin. 1958. 8p.

Ways of determining relative parity of hyperons and K mesons in the reactions with polarized proton beams were considered. (auth)

3203 NP-7064

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

ELECTRON-POSITRON PAIRS PRODUCED IN THE DECAY $\pi^0 \rightarrow e^- + e^+ + \gamma$. Yu. A. Budagov, S. Victor, V. P. Dzhelepov, P. F. Ermolov, and V. I. Moskalev. 1958. 7p.

Fourteen events of charge-exchange scattering of π^- mesons on hydrogen with a subsequent decay of the π^0 meson into an electron-positron pair and a γ ray were detected in a diffusion cloud chamber filled with hydro-

gen and placed into the 150-Mev π^--meson beam of a synchrocyclotron. The results of the observations on electron-positron pairs are tabulated. (A.C.)

3204 UCRL-3704

California. Univ., Berkeley. Radiation Lab. A POSSIBLE TEST OF TIME REVERSAL IN MU-MESON DECAY. T. Kotani. Mar. 4, 1957. 6p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

3205

THE NATURE OF SHOWERS GENERATED IN LEAD BY THE PENETRATING COMPONENT OF COSMIC RADIATION. S. Alper, E. Balea, E. Friedländer, and M. Mayer. Acad. rep. populare Romine Inst. fiz. atomica si Inst. fix. Studii cercetari fiz. 9, 175-80(1958). (In Rumanian)

2,988 hodoscope records were analyzed to obtain comparative information on the multiplicity and angular distribution of the soft component of δ showers and mixed nuclear showers. It is concluded that the markedly wider angular spread of the latter might provide an effective means of discrimination against δ showers in devices used for studying high energy nuclear interactions. (auth)

3206

OBSERVATIONS ON THE MASS SPECTRA OF σ MESONS. N. Fiuciuc and C. Potoceanu. Acad. rep. populare Romine Inst. fiz. atomica si Inst. fiz. Studii cercetari fiz. 9, 181-4(1958). (In Rumanian)

By the method of constant sagitta, the masses of the following stopped negative mesons were determined: 25 σ mesons giving stars with 1, 2, or 3 prongs, 19 σ mesons giving stars with 4 or 5 prongs, and 13 π mesons, for sake of comparison, from disintegrations. There were only two particles, one σ_4 and one σ_5 where the masses determined by constant sagitta that could be shifted within errors to ~500 m_e. Both tracks were short and gap measurements showed them to be pions too. (auth)

3207

STUDY ON THE IDENTIFICATION ON NON-STOPPED PARTICLES IN NUCLEAR EMULSIONS. I. ESTIMATION OF THE IONIZATION RANGE FROM AVERAGES OF CHARACTERISTIC QUANTITIES ON TWO SECTIONS OF THE TRACK. S. Alper, J. Ausländer, C. Bercea, and E. Friedländer (Institutul de fizică atomică, Bucharest) and A. Somogyi (Institutul central de cercetări de fizică, Budapest). Acad. rep. populare Romine Inst. fiz. atomica si Inst. fiz. Studii cercetări fiz. 9, 185-9(1958). (In Rumanian)

Scattering measurements and gap counting were made on 20 p, π, and μ tracks, at given distances from the end of the ionization range. The results show that only in favorable cases (long tracks) is it possible to establish, in a statistically significant manner, that the residual ionization range is different from zero. (auth)

3208

STUDY ON THE IDENTIFICATION OF NON-STOPPED PARTICLES IN NUCLEAR EMULSIONS. II. ESTIMATION OF THE RESIDUAL IONIZATION RANGE IN NUCLEAR EMULSIONS FROM GAP MEASUREMENTS. E. Friedländer. Acad. rep. populare Romine Inst. fiz. atomica si Inst. fiz. Studii cerecetari fiz. 9, 191-3(1958). (In Rumanian)

By applying a procedure of maximum likelihood, it is shown that the residual ionization range can be estimated from gap measurements. Results obtained on 15 p, π, and μ tracks confirm the correctness of the procedure used. (auth)

3209

STUDY ON THE IDENTIFICATION OF NON-STOPPED PARTICLES IN NUCLEAR EMULSIONS. III. THE DETERMINATION OF THE MASS OF IONIZING PARTICLES IN EMULSIONS. S. Alper. Acad. rep. populare Romine Inst. fiz. atomica si Inst. fiz. Studii cercetari fiz. 9, 195-202(1958). (In Rumanian)

It is shown that by applying conventional constant sagitta schemes to tracks of non-stopped particles it is possible, by an appropriate statistical treatment, to obtain an improved mass estimation. Measurements on 8 π and μ tracks, confirm the correctness of the procedure. (auth)

3210

PROTON-PROTON SCATTERING AT ENERGIES FROM 46 TO 147 Mev. J. N. Palmieri, A. M. Cormack, N. F. Ramsey, and Richard Wilson (Harvard Univ., Cambridge, Mass.). Ann. Phys. (N. Y.) 5, 299-341(1958) Dec.

The angular distribution of the differential cross section and polarization in proton-proton scattering have been measured at 147, 118, 95, and 66 Mev; at the highest energy the angular range was 4° to 112° (center of mass), while at the other energies the region considered fell between about 20° and 80°. In each case the differential cross section is a few percent higher at 40° than at 90°, in disagreement with the recent results of Taylor at Harwell. The angular distribution of $Pd\sigma/d\Omega$ indicates the necessity for F-waves in describing the interaction at 147 Mev, although these are not required at the lower energies. Measurements of the polarization at 45°, taken at 10-Mev intervals between 46 and 147 Mev, yield results about 20% higher than predicted by Gammel and Thaler. (auth)

3211

EMISSION OF CHARGED Σ + π FROM K^--PROTON CAPTURE IN NUCLEAR EMULSIONS. S. Nilsson and A. Frisk (Univ. of Uppsala). Arkiv Fysik 14, 303-14 (1958).

100 two-prong stars with charged baryons and π mesons only from K^- capture in nuclear emulsions have been analyzed. 23 $\Sigma^+ + \pi^-$, 30 $\Sigma^- + \pi^+$, and 9 $\Sigma^\pm + \pi^\pm$ events were compatible with captures on bound and free protons. A comparison between the experimental and expected hyperon energy distribution, using a degenerate Fermi gas model of the nucleus, gives a best fit for an attractive real Σ-nuclear potential of 25 Mev. An average Coulomb potential of the capturing nucleus of 8 ± 2 Mev is deduced. The fraction of zero prong Σ^- stars is 0.66 ± 0.10. The Σ^- mass is found to be $m_{\Sigma^-} = 1196.7 \pm 0.6$ Mev from three K^- captures on free protons. (auth)

3212

MULTI-PHONON PROCESSES IN SLOW NEUTRON SCATTERING BY CRYSTALS. Alf Sjölander (Univ. of Uppsala). Arkiv Fysik 14, 315-71(1958).

The multi-phonon processes in incoherent scattering of slow neutrons by crystals are discussed, assuming the harmonic approximation for the crystal vibrations. The differential scattering cross section is expanded in the Hermite orthogonal functions, and approximate expressions for the cross section are derived. Extensive numerical calculations have been carried out to illustrate the accuracy of the approximations made.

An approximation for the total cross section (the mass-ratio expansion) suggested by Placzek is discussed and in some respects generalized. The approximations for the differential cross section mentioned above are also used to derive approximate formulas for the total cross section valid for cold neutrons but arbitrary temperatures and mass ratios. (auth)

3213

INTERACTIONS OF 9 Bev PROTONS WITH NUCLEONS. V. S. Barashenkov, Van Shu-fen, and K. D. Tolstov. Atomnaya Energ. 5, 453-4(1958). Oct. (In Russian)

The statistical method was used in calculations of the angular distribution of charged "fast" particles emitted in p-p interactions. The theoretical and experimental results are in good agreement within the limits of experimental error. However, a considerable discrepancy was noted at small angles, possibly because mechanisms of formation are not described by the statistical method (peripheral collisions and such). The mean energy losses in p-p pion production, evaluated with the experimental number of fast particles and calculated energy spectrum, was equal to ~50% of the energy of the primary proton. (R.V.J.)

3214

THE QUENCHING OF TRIPLET POSITRONIUM BY IONS IN AQUEOUS SOLUTIONS. R. E. Green and R. E. Bell (McGill Univ., Montreal). Can. J. Phys. 36, 1684-95(1958) Dec.

Measurements of positron lifetimes in aqueous solutions have been performed using a fast time-to-amplitude converter with a resolving time of $\sim 10^{-9}$ sec. The lifetime, τ_2, of the long-lived component of the complex decay observed in water has been found to decrease when paramagnetic salts are added. The experimental results are interpreted in terms of "pickoff" annihilation to explain the observed τ_2 in pure water, and a rapid triplet $\rightleftharpoons$ singlet conversion process to account for the quenching of the τ_2 component. The conversion is caused by the presence of unpaired electrons in the structure of the paramagnetic atoms. Triplet $\rightarrow$ singlet conversion cross sections have been calculated on the basis of this interpretation and they range from 4.0×10^{-20} cm^2 for $NdCl_3$ to 3.8×10^{-18} cm^2 for $FeCl_3$. (auth)

3215

THE CHARACTERISTICS OF ELECTROMAGNETIC CASCADES IN A PHOTOGRAPHIC EMULSION WITH ALLOWANCE FOR THE INFLUENCE OF THE MEDIUM ON THE RADIATION PROCESSES. A. A. Varfolomeev, D. I. Golenko, and I. A. Svetlobov. Doklady Akad. Nauk S.S.S.R. 122, 785-7(1958) Oct. 11. (In Russian)

Electromagnetic cascades formed by electrons with initial energy 10^{11} to 10^{12} ev were calculated by the Monte Carlo method. Calculations considered actual non-asymptotic cross sections of elementary electromagnetic processes (particle energy functions). Two calculation variations are presented; the first variation used the Bethe and Heitler ratio for elementary processes, the other used the Magidal formulas in order to evaluate the effects of media on the high-energy electron emission processes. Experiments were made to check the effects of media on the bremsstrahlung processes of particle emissions of high energies. Results of each variant produced data for the electron-positron pair energy spectra formed at t_1 and t_2 depth for initial energy 10^{12} and 10^{11} ev. Some of the data permit an evaluation of the resulting fluctuations and the dependence of the fluctuations on the examined depth t_1, initial energy, and energy interval of secondary particles. (R.V.J.)

3216

STUDY ON THE THEORY OF THE ELECTRON. R. M. Berthier (Centre d'Etudes Scientifiques et Techniques, Grenoble, France). Helv. Phys. Acta 31, 576-8(1958). (In French)

Within the framework of Maxwell-Lorentz classic electrodynamics, limited relativity, and Bohr quantization, the theory of the electron is studied. The gyromagnetic anomaly and the dimensions of the electron are considered. (J.S.R.)

3217

CONTRIBUTION OF THE IMAGINARY PART OF THE AMPLITUDE OF THE DELBRUCK EFFECT TO THE ELASTIC SCATTERING OF PHOTONS. Paul Kessler. J. phys. radium 19, 739-44(1958) Oct. (In French)

An expression for the imaginary part of the amplitude of the Delbruck effect (elastic scattering of a photon by the electric field of nuclei) was derived. This expression is given in the form of two five-fold integrals, corresponding to the two possible polarization states of the photon. An approximate calculation of these integrals was made for a photon energy of 2.62 Mev and four different values of the scattering angle, with the help of an IBM 650 computing machine. (auth)

3218

THE MULTIPLICITY OF MESONS PRODUCED IN THE NUCLEAR INTERACTION OF HIGH ENERGY NUCLEONS AND α-PARTICLES IN COSMIC RADIATION. Shin-ichi Kaneko (Osaka City Univ.). J. Phys. Soc. Japan 13, 1258-65(1958) Nov.

It has been proposed that the multiplicity $n_\pm$ of charged mesons produced in the high energy nucleon-nucleon interaction can be empirically expressed as a function of the inelasticity K and the Lorentz factor γ_c in the center-of-mass system: $n_\pm \cong 3.5\ K(\gamma_c - 1)$ for $\gamma_c \lesssim 7$, $n_\pm \cong 9\ K(\gamma_c - 1)^{1/4}$ for $\gamma_c \gtrsim 7$. It is shown here that further experimental results published in recent years are also consistent with this dependence. It is also suggested, with the support of experimental material, that the peripheral collision of high energy α-particles with nuclei can be explained in terms of a superposition of a few nucleon-nucleon collisions so that the meson multiplicity in the interaction can also be represented by the above equations. The results of observation of a jet $(3 + 33\alpha)$ initiated by a high energy α-particle ($\sim 1.2 \times 10^{13}$ eV/nucleon) are described. (auth)

3219

DOSIMETRY OF NEUTRONS. L. Musumeci. Minerva nucleare 2, 303-7(1958) Oct. (In Italian)

The dosimetry of neutrons presents some particular aspects which are examined qualitatively. Such aspects concern the conditions in which neutrons are generated and their interactions with matter. The problem of the units and methods of dose measurements is discussed. In particular the difficulty of defining a correct unit from the physical point of view which has a direct biological meaning is considered. (auth)

3220

POLARIZATION PHENOMENA IN NEUTRON-PROTON RADIATIVE CAPTURE. W. Czyz (Univ. of Copenhagen). Nuclear Phys. 8, 621-36(1958) Nov. (2)

An analysis of the polarization phenomena in the

neutron-proton radiative capture and the photodisintegration of the deuteron is given. The usefulness of some polarization experiments is indicated. (auth)

3221

ON THE GROUP STRUCTURE OF ELEMENTARY PARTICLES. Feza Gursey (Univ. of California, Berkeley). Nuclear Phys. 8, 675-91(1958) Nov. (2)

An attempt is made to account for the group structure of elementary particles by assuming that they are obtained by combining a limited number of basic fields. It is shown that if the basic fields are all taken to be fermions, one needs three fields to account for the continuous group structure only, but four fields are necessary if distinct operations for C and P are to be incorporated in the scheme. On the other hand, a model with half the number of independent field components can describe the group structure correctly if both bosons and fermions are taken as basic fields, their common feature in this case being that they are all strange fields. Difficulties inherent in such schemes are discussed. (auth)

3222

BREMSSTRAHLUNG AND PAIR PRODUCTION OF PARTICLES OF SPIN $^3/_2$. A. A. Komar (P. N. Lebedev Physical Inst., USSR Academy of Sciences, Moscow). Nuclear Phys. 9, 6-21(1958-59) Nov. (3).

Bremsstrahlung and pair production for spin $^3/_2$ particles are computed in the lowest perturbation theory approximation. The ultrarelativistic case is considered in detail. The importance of small impact parameters is demonstrated. For a pure Coulomb nuclear field the cross sections are proportional to E^6, where E is the incident particle or photon energy. The effect of deviation of the nuclear electric field from that of a point Coulomb source is discussed. (auth)

3223

MULTIPLE PRODUCTION OF PARTICLES IN COLLISIONS BETWEEN 9 GEV PROTONS AND NUCLEONS. V. S. Barashenkov, V. A. Belyakov, E. G. Bubelev, et al (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 9, 74-82(1958-59) Nov. (3).

Theoretical results are compared with the results of some new experiments. 372 stars, of which 50 were classified as proton-nucleon collisions, were recorded in NIKFI-R photographic emulsions along the tracks of ≈9 Bev protons accelerated in the JINR proton synchrocyclotron. The mean number of charged particles created in these collisions was 3.6± 0.5. The angular distribution of fast charged particles is obtained. As a whole the experimental results agree with the statistical theory of multiple particle production within the limits of the experimental errors. Some discrepancy is evident in the small angle range and may be due to the contribution of non-central impacts and to asymmetry of the angular distribution in the c.m.s. (auth)

3224

ON THE HELICITY OF NEUTRINOS. Ingvar Marklund and Lorne A. Page (Inst. of Physics, Uppsala). Nuclear Phys. 9, 88-93(1958-59) Nov. (3).

In order to determine the helicity of neutrinos, the sign and magnitude of polarization of γ rays emitted in opposite direction to the neutrinos were measured. The 963-kev γ ray following electron capture by Eu^{152m} is thus measured to be 80 ± 30% circularly polarized with negative helicity. This result is in agreement with the measurement and conclusion by Goldhaber et al. that the emitted neutrino has negative helicity, $\sigma \cdot p = -1$ in this orbital electron capture. (auth)

3225

K^- INTERACTIONS WITH FREE PROTONS IN NUCLEAR EMULSION. R. G. Glasser, N. Seeman, and G. A. Snow (U. S. Naval Research Lab., Washington). Nuovo cimento (10) 9, 1085-90(1958) Sept. 16.

A total of 19(K^-,p) elastic scattering events and 14 $K^- + p \rightarrow \Sigma^\pm + \pi^\pm$ events in flight have been found, including the results reported previously. Averaging over the energy region (0 ÷ 82) Mev, the cross sections are respectively, $\sigma_e = (37^{+8}_{-8})$ mb and $\sigma_a = (27^{+8}_{-6})$ mb. The best estimate of the Σ^+/Σ^- ratio at production is $1.2^{+1.0}_{-0.6}$. (auth)

3226

PHENOMENOLOGICAL THEORY OF THE S MATRIX AND T, C AND P INVARIANCE (II). J. Werle (Univ. of Warsaw). Nuovo cimento (10) 9, 1091-1106(1958) Sept. 16.

The paper contains some applications of the general phenomenological theory of the transition matrix which has been given in part I of this work. Besides a general discussion of various physical relations which follow from the T, C, and TCP invariance requirements the examples of $K_{\mu 3}$ and hyperon decays are studied in some more detail. (auth)

3227

THE MESIC COUPLING CONSTANTS FROM SCATTERING AND PHOTOPRODUCTION EXPERIMENTS. L. Bertocchi and A. Minguzzi (Istituto di Fisica dell' Universita, Bologna and Istituto Nszionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 9, 1107-9(1958) Sept. 16.

The π-N scattering dispersion relations can be used as a tool for defining the renormalized meson-nucleon coupling constant, the coupling constant being defined by the ratio $[\langle p'|J(0)|p\rangle]/[\bar{u}(p')\gamma_5 u(p)] = g(p'-p)^2$, taken at the point $(p'-p)^2 = -\mu^2$; J(O) is the meson current operator, g is a real, invariant function of $(p'-p)^2$. Even the photoproduction dispersion relations, when the photon field in the nonphysical range is neglected, allow one to define the mesic coupling constant and this constant must be a priori identical to the one defined by the π-N scattering dispersion relations. In order to establish the relation between the two definitions of the mesic coupling constant, it is more convenient to use the rederivation of the Kroll-Ruderman theorem in the Heisenberg representation, as done by Low. The threshold S-matrix amplitude for charged meson photoproduction allows the definition of the mesic coupling constant through the above ratio, taken at the point $(p'-p)^2 = 0$. This definition is a consequence of the essential hypothesis, used in order to establish the Kroll-Ruderman theorem, that the mass of the «real» final meson vanishes. An attempt has been made to examine what is the difference between the two definitions of the mesic constant; clearly in the fixed source limit this difference vanishes. Since this is not the case in the relativistic treatment, a perturbative approach has been used in order to estimate this difference. (auth)

3228

CHARGED MESON-NUCLEON DISPERSION RELATIONS WITH FIXED NUCLEONS. A. Minguzzi (Istituto di Fisica dell'Universita, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 9, 1114-16(1958) Sept. 16.

Consideration is given to a general case of meson-nucleon dispersion where a pair of mesons with different masses are strongly coupled to the nucleon field. Following the procedure of Symanzik it is straight forward to see that the conventional dispersion relations for a single mass meson continue to hold for the meson of lower mass; however for the meson of higher mass they still have to be proved. It follows that, due to the difference between the mass of the charged and uncharged mesons, the scattering dispersion relations are rigorously proved only for (π^0,N) scattering. (auth)

3229

PROTON GYROMAGNETIC RATIO. R. L. Driscoll and P. L. Bender (National Bureau of Standards, Washington). Phys. Rev. Letters 1, 413-14(1958) Dec. 1.

The proton precession frequency has been measured in a 12-gauss magnetic field supplied by a precision solenoid. For protons in water the preliminary result obtained in terms of the NBS electrical standards is $\gamma_p = (2.67515 \pm 0.00001) \times 10^4$ gauss^{-1} sec^{-1}. Benzene was found to give a result 1.9 ± 0.2 ppm higher. (T.B.A.)

3230

RANGE OF THE SPIN-ORBIT FORCE BETWEEN TWO PROTONS. P. S. Signell and R. Zinn (Bucknell Univ., Lewisburg, Penna.) and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. Letters 1, 416-18(1958) Dec. 1.

The effect of decreasing the range of the spin-orbit potential to the "meson-theoretical" value of 0.7×10^{-13} cm was investigated. The spin-orbit force is not unique. A reduction in range does not harm agreement with the p-p scattering data at 150 Mev. At 300 Mev, the reduced range yields phase shifts which constitute a distinct improvement over the previous ones. Short-range repulsive cores can readily be introduced into the Gartenhaus potential to eliminate the unphysical bound states without adverse effects on the scattering. It is not excluded that a more exotic combination of spin-orbit and modified Gartenhaus potentials can explain the p-p scattering data up to 300 Mev. (T.B.A.)

3231

PARITY AND OTHER SYMMETRIES IN STRONG INTERACTIONS. A. Pais (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. Letters 1, 418-20(1958) Dec. 1.

The question of whether the high degree of P-conservation in nuclear phenomena precludes any P-violation in strong interactions is discussed. Reactions are given which give further guidance concerning P-conservation and the structure of a possible doublet approximation (DA). It is observed that the possible existence of a DA would hold out a promise that CP-invariance is the truly universal reflection principle. (T.B.A.)

3232

AN ATTEMPT AT REFORMULATING PION-NUCLEON INTERACTION. II. SCATTERING OF ANTIPROTON BY NUCLEON. Osamu Hara and Yasunori Fujii (Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 89-107(1958) July.

Scattering of antiprotons by nucleons is calculated assuming "nucleonic charge independence," in which nucleon and antinucleon are assumed to correspond to the third component of an angular momentum in the charge space and its conservation is assumed. It is shown that according to this assumption, the elastic and the charge exchange parts of the antinucleon-nucleon scattering are related to the nucleon-nucleon scattering in a simple way, just as neutron-proton scattering is related to the proton-proton scattering by charge independence. Explicit results are given for the total cross sections and the angular distributions of the elastic and the charge exchange parts of ($\bar{p}p$) scattering and for the elastic part of ($\bar{p}n$) scattering. As far as the comparison with experiment is possible, the result predicted by the theory is not unreasonable. (auth)

3233

THE GLOBAL SYMMETRY OF PION-BARYON INTERACTIONS AND BOUND STATES OF HYPERON-NUCLEON SYSTEM. Yoshio Yamaguchi (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 112-14 (1958) July.

3234

GLOBAL SYMMETRY AND THE BRANCHING RATIOS FOR THE K^- CAPTURE BY THE NUCLEON. Ken Kawarabayashi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 117-25(1958) Aug.

Branching ratios for the K^- capture by the nucleon are studied to investigate the validity of Gell-Mann's global symmetry. The following assumptions are made: (1) Gell-Mann's global symmetry is valid, (2) K meson is pseudoscalar, (3) mass differences among baryons can be neglected, and (4) processes involving K mesons are described by treating the coupling as perturbations in the lowest order that gives the effect. Under these assumptions, the matrix element for the processes are expressed in terms of the $\pi-N$ scattering matrix elements for which experimental data can be used. The branching ratios are compared with experimental results. (auth)

3235

PHENOMENOLOGICAL MODEL ON THE INTERACTIONS OF ELEMENTARY PARTICLES. II. Kanji Fujii and Kenzō Iwata (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 20, 126-32(1958) Aug.

Many authors have shown that the universal V-A coupling of the Fermi interaction is not inconsistent with various experimental results. Their assumptions are more or less ad hoc. In this paper, it is shown phenomenologically that the universal V-A coupling is a natural and almost unique consequence of the common character of the interactions belonging to each stratum of interaction strength; especially, a possibility of $S-T-P$ coupling of β-decay interaction is definitely excluded. To lead to this end, one additional assumption is used, setting the relation between a weak boson-fermion interaction and the fundamental interaction. (auth)

3236

ISOTOPIC SPIN SELECTION RULE IN Σ-DECAYS. Tetsuo Eguchi and Shozo Nagata (Kyushu Univ., Fukuoka). Progr. Theoret. Phys. (Kyoto) 20, 144-8 (1958) Aug.

Use is made of the branching ratio, lifetimes, and asymmetries of the angular distributions in Σ decays to show that the selection rule $|\Delta I| = \frac{1}{2}$ is consistent in the decays of Σ hyperons as well as in the Λ decays. The invariance under time reversal is assumed, and the asymmetry parameters, the average degrees of polarization of Σ, and the ratios of the coupling constants are obtained. (auth)

3237

ABSORPTION EFFECTS IN ANTINUCLEON PHENOMENA. Y. Kakudo, T. Kammuri, and R. Nakasima (Osaka Univ. and Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 243-5(1958) Aug.

The absorption effects in antinucleon phenomena are examined to explain the results of certain experiments. Two experiments are considered: antiproton production by a 6.1-Bev proton beam and antineutron production by charge exchange of a 440-Mev antiproton. (A.C.)

3238

COUPLING CONSTANT OF KAON-BARYON INTERACTION. I. Akira Komatsuzawa, Reiji Sugano (Kyoto Univ.), and Yukihisa Nogami (Univ. of Osaka Prefecture, Sakai Japan). Progr. Theoret. Phys. (Kyoto) 20, 246-9(1958) Aug.

It is pointed out, by assuming a simple coupling type, that a physical requirement on the low-energy K–N scattering restricts the magnitude of the coupling constant. (A.C.)

3239

COUPLING CONSTANT OF KAON-BARYON INTERACTION. II. Akira Komatsuzawa and Reiji Sugano (Kyoto Univ.) and Yukihisa Nogami (Univ. of Osaka Prefecture, Sakai Japan). Progr. Theoret. Phys. (Kyoto) 20, 249-50(1958) Aug.

In the preceding paper an upper bound of the coupling constant of kaon-baryon interactions was estimated based on the assumption that there exists no bound state of K + N. This restriction is valid but too lenient. For a more practical orientation about the order of magnitude of the coupling constant, an estimation of the cross section for the low-energy K^+ + p scattering is made and compared with experimental data. (A.C.)

3240

ELASTIC SCATTERING OF 300 Mev π-MESONS ON DEUTERONS. L. S. Dulkova, I. B. Sokolova, M. G. Shafranova (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 313-15(1958) Aug. (In Russian)

The interaction of 300 ± 15 Mev π^+ mesons and 295 ± 10 Mev π^- mesons with deuterons was studied with the aid of photographic plates impregnated with deuterated lithium acetate. The cross sections and angular distributions of π^+ and π^- mesons elastically scattered by deuterons were investigated. (tr-auth)

3241

ENERGY DEPENDENCE OF $\mu^+ - e^+$ DECAY ASYMMETRY. A. I. Mukhin, E. B. Ozerov, and B. Pontekorvo (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 340-7(1958) Aug. (In Russian)

The energy dependence of the asymmetry of polarized μ-meson decay electrons was studied with the help of a set of scintillation counters biased against bremsstrahlung. Measurements were made for electron energies above 20 Mev. The dependence quantitatively (within a few per cent) agrees with that predicted by the two-component neutrino theory. The experiments indicate that the degree of polarization of the μ-meson beam is 0.81 ± 0.11. (tr-auth)

3242

ON THE INTERACTION BETWEEN THE ELECTRON AND OTHER PARTICLES AT SHORT RANGES. N. N. Kolesnikov and Zh. Zhacobi (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 381-91(1958) Aug. (In Russian)

The possibility of existence of an electron structure and its description by the linear theory of extended particles and the nonlinear theory are discussed. Both theories lead to close results for the interaction between the electron and proton, neutron, and light nuclei; however, according to the nonlinear theory the interaction between two electrons at very small distances should appreciably differ from the electron–positron interactions. (tr-auth)

3243

FORMATION OF π MESON PAIR IN COLLISIONS BETWEEN π MESONS OR γ-QUANTA WITH NUCLEONS OR DEUTERONS. N. V. Dushin (Leningrad Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 401-7(1958) Aug. (In Russian)

The production of two π particles in collisions between π particles or γ quanta with nucleons or deuterons is studied by a phenomenological method for small angles of emission of the produced π particles. (tr-auth)

3244

ON β DECAY OF HYPERONS. V. M. Shekhter (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 458-66(1958) Aug. (In Russian)

The probabilities of decay of hyperons into nucleons (hyperons) and leptons are computed. The energy distribution, correlations, polarization, and asymmetry of emission of the particles are determined. Numerical calculations are performed for the case of a universal V–A interaction. The probabilities of lepton decays of Σ^- and Λ° hyperons are found to exceed considerably the corresponding upper experimental limits. (tr-auth)

3245

PROJECTIVE OPERATORS IN ELEMENTARY PARTICLE THEORY. F. I. Fedorov (Inst. of Physics and Math., Academy of Sciences, Belorussian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 493-500(1958) Aug. (In Russian)

Projective matrices (diads) describing any possible state of a particle with arbitrary spin are set up with aid of minimal polynomials of the relativistic wave equation matrices and the spin matrices. The main physical quantities (energy-momentum, current-charge, transition probability) can be directly expressed in terms of these projective operators in an invariant manner (irrespective of the choice of the representation basis). As a result, calculation of various effects for any type of spin particle reduces to the evaluation of the traces of certain combinations of the matrices. As applications of the method the general conditions of definiteness of energy and charge for particles of a single mass are derived and a simple deduction is presented for the general commutation relations for particle of an arbitrary spin. (tr-auth)

3246

DIFFRACTION SCATTERING OF 6.15 Bev PROTONS ON PROTONS. V. G. Grishin (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 501-4 (1958) Aug. (In Russian)

Phase-shift analysis for diffraction scattering of 6.15-Bev protons on protons is carried out. The spatial distribution of the absorbing field is deduced from the results of an analysis in the quasi-classical approximation. The value 0.79×10^{-13} cm was obtained for the mean square proton-proton nuclear interaction range. (tr-auth)

3247

ON THE THEORY OF π^0-MESON COMPONENTS. M. E. Perel'man (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 508-9(1958) Aug. (In Russian)

A scheme of π^0-meson decay is characterized by a sum of two exponents. According to the suggested scheme π^0 and ρ^0 mesons participate in strong interactions which conserve the total isotopic spin while π_1 and π_2 mesons participate in electromagnetic and weak interactions. A possibility is suggested that different lifetimes of mesons emitted in various processes (for π^0 mesons in nucleon-nucleon interactions, or strong interactions, $\tau \sim 5 \times 10^{-15}$ sec and for π^0 mesons produced in K meson decay or weak interactions, $\tau \leq 5 \times 10^{-16}$ sec) may be related to the above scheme. According to the offered scheme π^0 or ρ^0 mesons are emitted in the first case and π_1 and π_2 mesons in the second case. (R.V.J.)

3248

ON THE PROBLEM OF TWO NUCLEON INTERACTIONS IN TAMM-DANCOFF METHOD. A. A. Rukhadze. Zhur. Eksptl'. i Teoret. Fiz. 35, 511-12(1958) Aug. (In Russian)

The tabulated data show that the part played by the term of g^4 order in nucleon interactions for the problem of bound-state deuterons is not important, while in the problem of nucleon scattering in the $^1S_0$ state the contribution of the term of g^4 order is considerable. Comparisons of the experimental and theoretical magnitudes indicate that qualitatively the theory correctly describes the nucleon interactions at low energies ($E < 20$ Mev). For $E = 50$ Mev the calculated phase δ ($^1S_0$) is considerably smaller than the experimental which shows the inadequacy of the theory. (R.V.J.)

3249

K_{e3} DECAY WITH γ QUANTA EMISSION. I. M. Dremin (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 35, 515-17(1958) Aug. (In Russian)

The process $K^0 \rightarrow \pi^+ + e^+ + \nu + \gamma$ is considered, and a general lagrangian for K_{e3} decay interaction is written with the assumption that the π meson, electron, and neutrino are formed at one point on the Feynman diagram and the K^0 meson spin is equal to 0. (R.V.J.)

3250

ENERGY DEPENDENCE OF ASYMMETRY COEFFICIENT IN $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ DECAY IN THE LOW ENERGY SECTION OF POSITRON SPECTRA. V. V. Barmin, V. P. Kanavets, B. V. Morozov, and I. I. Pershin. Zhur. Eksptl'. i Teoret. Fiz. 35, 542-4(1958) Aug. (In Russian)

3251

ISOTOPIC INVARIANCE IN PROCESSES WITH ANTIHYPERON PARTICIPATION. S. G. Matinyan and G. R. Khutsishvili (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 546-7 (1958) Aug. (In Russian)

Processes of formation and interactions of antihyperons with nucleons and light nuclei based on isotopic invariance are studied. (R.V.J.)

3252

ON THE PROBLEM OF ANGULAR CORRELATION BETWEEN SECONDARY PARTICLES FORMED IN NUCLEAR COLLISIONS AT HIGH ENERGIES. I. M. Gramenitskii, M. Ya. Danysh, et al. (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 552-3(1958) Aug. (In Russian)

Correlations of the emission directions of secondary relativistic particles produced in 9 Bev proton reactions with nuclei in photoemulsions were studied. Measurements were made of the magnitudes of coefficients of angular correlation between the number of particles escaping at various solid angles. (R.V.J.)

3253

ELECTRON TRANSITION EFFECT ON THE IONIZATION CHAMBER WALLS. V. A. Dmitriev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 553-4 (1958) Aug. (In Russian)

Variations in the electron number during the electron-photon cascade transition from lead into the iron wall were calculated with considerations for the low-energy electron tracks. The electron and photon equilibrium spectrum was studied taking into account the dependence of the total coefficient of photon absorption on the energies. The evaluation can be applied to lead thickness equal to and above t_{max} (the cascade depth maximum) because the electron spectrum maximum in lead is close to equilibrium and changes slowly with the depth. The sharp drop in electron number with thinner thickness of the iron is caused by ionization electron stopping and by the softness of the energy spectrum in lead. With the wall thickness change from 1 to 3 mm the transition effect varies only 8%. (R.V.J.)

3254

THE EFFECT OF A MAGNETIC FIELD ON THE LIFE OF POSITRONS IN SOLID MATTER. D. Freytag and K. Ziock (Univ. of Bonn). Z. Physik 153, 124-8(1958). (In German)

In the measurement of the life of positrons in solid matter, a long-lived part was found which led back to the formation of triplet positronium. The life of this long-lived part was measured in polystyrol. The effect of a magnetic field on this life was determined, and it was in agreement with the value calculated from the Zeeman effect of positronium. (tr-auth)

Heat Transfer and Fluid Flow

3255 AECU-3901

[Du Pont de Nemours (E. I.) & Co. Explosives Dept., Wilmington, Del.]

EXTENSION OF THE METHOD OF BURNOUT PREDICTION. Louis Bernath. [1958]. 10p. $1.80(ph OTS); $1.80(mf OTS).

The method of prediction of burnout heat flux with local boiling was extended to include geometries from the confined, forced-flow systems of the original method to pool boiling, natural circulation conditions. A new formula for the limiting (ultimate) heat transfer coefficient is presented and is shown to correspond closely to the former expression for comparable geometric configurations. Heat fluxes at burnout predicted by the new formula are compared with experimental values used in the original method and with more recent data. The agreement between predicted and experimental heat fluxes is illustrated. 50% of the data are predicted within 11.5% by the method. (auth)

3256 AECU-3934

General Electric Co. General Engineering Lab., Schenectady, N. Y.

CRITERIA FOR UPWARD ANNULAR TWO PHASE

FLOW. D. H. Brown, E. L. Lustenader, and F. J. Neugebauer. Oct. 15, 1958. 19p. (58-GL-288). $3.30 (ph OTS); $2.40(mf OTS).

A direct theoretical analysis was undertaken of upward annular two-phase flow. Inadequacies in experimental correlations indicate that the present theoretical models are either in error or are incomplete. Application was made of modern knowledge in the fields of boundary layer theory and film condensation. It was established that correlations and analytical methods that superimpose force fields, such as that of gravity, on the flow result in unrealistic patterns for flow distribution, fluid shear, and local pressure drop. Success with such methods may be attributed to grossly compensating errors. The analysis was carried to the point of determination of the interface wave phenomenon. A further program of investigation of wave phenomenon for inclinations from horizontal to vertical is recommended. (auth)

3257 APEX-465

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

TOTAL PRESSURE LOSS IN MIXING OF SKEWED VELOCITY PROFILES. R. N. Noyes. Oct. 10, 1958. 7p. (XDC-58-10-165). $1.80(ph OTS); $1.80(mf OTS).

The analysis and working curves are presented for the determination of the loss in total pressure due to the mixing of a skewed velocity profile (change over to a symmetrical profile) in a constant area duct. (auth)

3258 CF-58-10-121

Oak Ridge National Lab., Tenn.

ASYMPTOTIC VALUES OF THE HEAT TRANSFER COEFFICIENT FOR LAMINAR BINGHAM PLASTIC FLOW IN PIPES. R. P. Wichner. Oct. 31, 1958. 7p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A theoretical relation between the Nusselt modulus and the ratio τ_y/τ_w is derived for the case of fully developed laminar Bingham flow in pipes. (auth)

3259 HW-56946

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

METHODS FOR INVESTIGATING CRITICAL DISCHARGE PHENOMENA WITH SATURATED WATER. E. D. Waters. Aug. 29, 1958. 23p. Contract W-31-109-Eng-52. $0.75(OTS).

Experimental procedures and techniques are described which allow the convenient determination of the point at which critical flow occurs with saturated water in a piping assembly. Values of upstream pressure, temperature, and the maximum discharge flow rate were investigated using these procedures. Some data are presented in examples which illustrate the techniques. The significance of the critical flow phenomenon is discussed when it occurs in the piping of a nuclear reactor. Also discussed is the effectiveness of temperature monitoring elements located in or near the region of critical flow. (auth)

3260 NASA-M-12-4-58W

Stanford Univ., Calif.

HEAT TRANSFER IN THE TURBULENT INCOMPRESSIBLE BOUNDARY LAYER. IV. EFFECT OF LOCATION OF TRANSITION AND PREDICTION OF HEAT TRANSFER IN A KNOWN TRANSITION REGION. W. C. Reynolds, W. M. Kays, and S. J. Kline. Dec. 1958. 29p.

The effect of location of transition on heat transfer to the turbulent incompressible boundary layer is analyzed. The analysis indicates that considerably higher heat-transfer rates may occur for some distance downstream if the transition is very late. The results of a limited experimental investigation are in substantial agreement with the analytical results. If the extent of the transition region is known, the analysis also allows adequate prediction of heat-transfer coefficients within the transition region. The analysis should also predict local shear coefficients in the transition region. (auth)

3261 ORNL-2603

Oak Ridge National Lab., Tenn.

AN INVESTIGATION OF THERMAL-TRANSIENT DECAY AT A FLUID-SOLID INTERFACE AND IN TURBULENT FLOW THROUGH CIRCULAR DUCTS. J. J. Keyes, Jr. and J. E. Mott. Dec. 15, 1958. 58p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

Analytical and experimental heat-transfer studies are presented which are related to attenuation of relatively high-frequency thermal oscillations in fluid-solid systems. Oscillations in fluid temperature may originate in certain high-flux reactors and can cause thermal fatigue failure of metal components. It is of interest to know to what extent these oscillations will be felt at a metal surface and how they might decay in passage through reactor flow channels. Thus, the studies reported are intended to aid in the analysis of cyclic thermal stress effects. The cases studied include: local radial attenuation of sinusoidal fluid temperature oscillations at the surface of a thick-walled plate or pipe; and axial decay of sinusoidal fluid temperature oscillations in circular ducts for cases of negligible and of appreciable heat exchange with the duct wall. Agreement of the experimental results with theory is sufficiently accurate for most engineering purposes. Some significant discrepancies are noted, however. (auth)

3262 GAT-Z-4060

HEAT TRANSFER IN THE CONDENSATION OF VAPORS WITH NONCONDENSABLE GASES PRESENT. Wolfgang Renker. Translated for Goodyear Atomic Corp. from Wiss. Z. tech. Hochschule (Dresden) 4, 1003-19(1954/55).

Faculty of Mechanical Engineering Publication No. 79.

Condensation of vapors from flowing mixtures of vapor and gas upon heat transfer was examined. Vapor–gas mixtures of steam–air, steam–hydrogen, isobutyl alcohol vapor–nitrogen, and isobutyl alcohol vapor–hydrogen were investigated. The flow velocity was controlled at 2 to 25 m/sec, and the partial pressure was 2 atm. The measurements indicated that the high coefficients of the heat transfer for pure vapors drop sharply even when minute quantities of gas are added, and the lower the flow velocity, the more pronounced this effect. The experimentally determined coefficients of heat transfer were used to calculate the thickness of the boundary layer. A semiempirical equation was derived to calculate the coefficients of heat transfer. (J.R.D.)

Nuclear Properties and Reactions

3263 NP-7026

Polish Academy of Sciences. Inst. of Nuclear Research, Krakow.

RESULTS OF MEASUREMENTS OF SPIN LATTICE RELAXATION TIMES IN LIQUIDS OBTAINED IN THE CRACOW LABORATORY OF NUCLEAR MAGNETIC

RESONANCE. J. W. Hennel, A. Z. Hrynkiewicz, K. Krynicki, T. Waluga, and G. Zapalski. [1957]. 3p.

The preliminary results of the investigation of spin-lattice relaxation times in pure water, pure chloroform, and water solutions of gelatin are described. (W.L.H.)

3264 NYO-8059

Rochester, N. Y. Univ.

REACTION CROSS SECTION FOR 4 MEV DEUTERONS ON Cu^{63}. I. Slaus and W. Parker Alford. Nov. 12, 1958. 12p. Contract AT(30-1)-875. $3.30(ph OTS); $2.40(mf OTS).

A measurement of the deuteron absorption cross section was made for Cu^{63} at 4 Mev. Possible reactions initiated by 4-Mev deuterons on Cu^{63} are listed in tabular form along with their Q values. (A.C.)

3265 ORNL-2375

Oak Ridge National Lab., Tenn.

MONTE CARLO CALCULATIONS OF FLUXES AND DOSE RATES RESULTING FROM NEUTRONS MULTIPLY SCATTERED IN AIR. F. L. Keller, C. D. Zerby, and J. Hilgeman. Dec. 31, 1958. 28p. Contract W-7405-eng-26. $1.00(OTS).

A Monte Carlo code previously developed for the Oracle was used for a parameter study to calculate the fluxes and dose rates resulting from neutrons multiply scattered in air. Both the source and the detector were assumed to be suspended in an infinite body of air (ρ = 0.00125 g/cm^3), and the source was assumed to be a point source which emitted a monoenergetic line-beam of neutrons at various angles with respect to the source-detector axis. Calculations were performed for separation distances, g, of 5, 10, 20, 40, 64, and 100 ft; for source energies, E_0, of 5, 3, 2, 1.2, and 0.55 Mev; and for beam angles, θ_0, of 2, 15, 30, 60, 90, 135, and 180°. The scattering was assumed to be isotropic in the center-of-mass system. The results of the flux calculations were found to fit the expression $\Sigma_s(E_0)/4\pi g \cdot \pi - \theta_0/\sin\theta_0$, where $\Sigma_s(E_0)$ is the total macroscopic scattering cross section of air at the initial energy of the neutron. The results of the dose-rate calculations were found to fit the expression $^1/_{1.2} \cdot C(E_0)\Sigma_s(E_0)/4\pi g \cdot \pi - \theta_0/\sin\theta_0$, where $C(E_0)$ is the flux-to-dose rate conversion factor. (auth)

3266 ORNL-2462

Oak Ridge National Lab., Tenn.

GAMMA-RAY DOSE RATES RESULTING FROM NEUTRON CAPTURES IN AIR. F. L. Keller, C. D. Zerby, and W. W. Dunn. Dec. 31, 1958. 36p. Contract W-7405-eng-26. $1.25(OTS).

A Monte Carlo calculation of the gamma-ray fluxes and dose rates resulting from neutron captures in air was performed. For this calculation the source was assumed to be monoenergetic, and both the source and detector were assumed to be suspended in an infinite body of air. The neutron source was taken to be either a point isotropic or a line-beam source, and the dose rate and angular distribution of capture gamma rays at the detector were determined. For the point isotropic source and a 50-ft separation distance it was found that the dose rate varied with the neutron source energy approximately as $E^{-1/2}$. When curves for the various monoenergetic line-beam sources and a 65-ft separation distance were plotted as a function of the beam angle, they were relatively flat over the region from 30 to 180 deg, becoming flatter as the source energy increased. (auth)

3267 UCRL-8528

California. Univ., Berkeley. Radiation Lab.

SPECTRUM AND YIELD OF NEUTRONS FROM 31.5-MEV PROTON BOMBARDMENT OF SELECTED ISOTOPES OF COBALT AND NICKEL (thesis). Hoyt A. Bostick. Oct. 10, 1958. 105p. Contract W-7405-eng-48. $2.50(OTS).

Protons from the University of California 31.5-Mev linear accelerator were used to bombard thin targets of Ni^{58}, Ni^{60}, and Co^{59}. Neutrons arising from the resulting reactions were detected with a 4-inch liquid hydrogen bubble chamber. Three spectrometer positions, 53, 90, and 127° in the laboratory system, were employed in measuring the angular dependence of neutron production from these targets. Energy spectra of neutrons with energies greater than 5 Mev were determined by reconstruction of recoil proton tracks in the liquid hydrogen. Cross sections for neutron production were found in nickel to have an isotopic dependence; the yield of neutrons from Ni^{60} was significantly greater than that from Ni^{58}. The yield from Co^{59} exceeded that from Ni^{60} by a smaller amount. Angular distributions of the neutron spectra of all targets showed anisotropic characteristics. The angular dependence observed for the neutron spectra from all targets has been interpreted as being composed of a combination of isotropic evaporation-type spectra and a distribution concentrated in the forward hemisphere which is characteristic of direct interaction processes. Occupation numbers for incompletely filled neutron shells in the nucleus may be related to the observed $Ni^{60}-Ni^{58}$ cross-section differences in the data. (auth)

3268

VARIATIONAL PRINCIPLE IN THE OPTICAL MODEL OF NUCLEAR REACTIONS WITH NEUTRONS. I. Brănduş. Acad. rep. populare Romine Inst. fiz. atomica si Inst. fiz. Studii cercetari fiz. 9, 251-8(1958). (In Rumanian)

The cross-section formulas for neutron collisions with nuclei, calculated in the optical model on the basis of Schwinger's variational principle are given. (auth)

3269

STUDIES OF A NUCLEAR INTERACTION WITH ENERGY OF $\sim 4 \times 10^{11}$ ev. E. Balea and E. Friedländer. Acad. rep. populare Romine Inst. fiz atomica si Inst. fiz. Studii cercetari fiz. 9, 259-68(1958). (In Rumanian)

A 4 + 17 α meson shower registered in a stratosphere-flown emulsion was analyzed with respect to the angular and energetic distribution of its secondaries. The primary energy estimated by several methods turns out to be $\sim 4 \cdot 10^{11}$ ev. In the c.m.s., the angular distribution shows no strong anisotropy but only a slight asymmetry, favoring backward emission. Two secondary interactions yield information concerning energy transfer. It seems likely that $\sim ^3/_4$ of the primary energy was carried away by a single secondary (most probably a neutron). (auth)

3270

HISTORY OF COSMIC RADIATION. Louis Leprince-Ringuet. Age nucléaire No. 7, 16-22(1957) Nov.-Dec. (In French)

A brief survey is prevented of the historical growth of the knowledge of cosmic radiation, from the residual radiation noticed in ionization chambers in 1910 to the discovery of the antiproton in 1955. (J.S.R.)

3271

COSMIC RADIATION AND THE SOLAR SYSTEM. Jean Heidmann. Age nucléaire No. 7, 23-6(1957) Nov.-Dec. (In French)

A brief survey is presented of the information given at the conference held at Varenne, Italy, in June 1957, on cosmic radiation. (J.S.R.)

3272

EXPERIMENTAL STUDY OF HIGH ENERGY INTERACTIONS PRODUCED IN PHOTOGRAPHIC EMULSIONS. INTERPRETATION BY A MONTE-CARLO METHOD. EVIDENCE OF INSTANTANEOUS SUB-STRUCTURES IN LIGHT NUCLEI. Jean Combe. Ann. phys. 3, 468-509 (1958) July-Aug. (In French)

An experimental study was made of the interactions of neutrons of 90 to 270 Mev and 340-Mev protons with the nuclei of photographic emulsions. The stars produced by light nuclei were distinguished from those by heavy nuclei. The two sorts of nuclei show a clear difference in the charge exchange of the incident proton during its passage through the nucleus. A quantitative study was made of the experimental results to describe the passage of the nucleon through the nucleus. For the heavy nucleus the Goldberger model was used with the Monte Carlo method to obtain a usable scheme for the passage of the incident nucleon. This scheme, however, is not completely applicable to the description of the passage through light nuclei. The idea of instantaneous substructures in light nuclei is introduced to complete the description of the nucleon incident on light nuclei. 73 references. (J.S.R.)

3273

CONTRIBUTION TO THE STUDY OF THE PROBABILITIES OF γ TRANSITIONS BY THE METHOD OF DELAYED COINCIDENCES. APPLICATION TO SOME MAGNETIC AND ELECTRIC DIPOLAR TRANSITIONS. Hamlet Vartapetian. Ann. phys. 3, 569-628(1958) July-Aug. (In French)

An experimental study is made of the electric dipolar transitions in the deformed nuclei Lu^{175}, Hf^{177}, Ra^{223}, and Pa^{224} and of the magnetic dipolar transitions in Cs^{131} and Pa^{224}. The method of measurement of the periods of the excited levels is discussed, and the rapid coincidence apparatus used is described. The results are discussed in detail. (J.S.R.)

3274

THE MAGNETIC DIPOLE TRANSITIONS IN Xe^{129m} AND Cs^{133}. T. Alväger, B. Johansson, and W. Zuk. Arkiv Fysik 14, 373-82(1958).

The half life of the 1-forbidden magnetic dipole transition in Xe^{129m} has been measured to be $0.7 \pm 0.3 \times 10^{-9}$ s by the method of delayed coincidences and by using a multichannel time analyzer. A comparison with other transitions of the same kind shows a slight deviation for Xe^{129m}. In Cs^{133} the half life of the 80-kev M1 transition has been remeasured to be $6.3 \pm 0.2 \times 10^{-9}$ s. (auth)

3275

THE MASS DISTRIBUTION OF FRAGMENTS RESULTING FROM THE FISSION OF U^{235}, U^{238}, AND Pu^{239} INDUCED BY 14.6 Mev NEUTRONS. A. N. Protopopov, G. M. Tolmachev, et al. Atomnaya Energ. 5, 130-4 (1958). (In Russian)

Methods and results of measurements are presented of the relative yields of fragments formed in U^{235}, U^{238}, and Pu^{239} fission by 14.6-Mev neutrons. Fragment mass distribution curves are plotted. Peculiarities of certain distributions are discussed. (tr-auth)

3276

ON THE URANIUM NUCLEI COMPLEX FISSION PRODUCED BY 14 Mev NEUTRONS. N. A. Perfilov and Z. I. Solov'eva. Atomnaya Energ. 5, 175-6(1958). (In Russian)

Uranium complex fission, with long-range α-particle emission, by 14-Mev neutron irradiation was studied. (R.V.J.)

3277

MEAN NUMBER OF NEUTRONS EMITTED IN Am^{241} FISSION BY THERMAL NEUTRONS. V. I. Lebedev and V. I. Kalashnikova. Atomnaya Energ. 5, 176-7 (1958). (In Russian)

The mean number of neutrons emitted in a single Am^{241} fission (ν) by thermal neutrons was determined in relation to the magnitude of ν for U^{235}. The ratio $\nu(Am^{241})/\nu(U^{235}) = 1.27 \pm 0.01$ was obtained on the basis of the universally accepted value $\nu(U^{235}) = 2.47 \pm 0.03$. (R.V.J.)

3278

ELECTROMAGNETIC TRANSITIONS IN ISOMERIC NUCLEI. L. I. Rusinov and D. A. Varshalovich. Atomnaya Energ. 5, 432-45(1958). Oct. (In Russian)

The probabilities of gamma emission from nuclear isomers are correlated with the theoretical data. The correlation is carried out for the permitted and forbidden j and l transitions in spherical nuclei and between levels of one rotational band, as well as in the single-particle and K-forbidden transitions in deformed nuclei. The experimental data on the electromagnetic emission and quantum characteristics of nuclear isomers are in good agreement with the existing theories of nuclear structure. (tr-auth)

3279

SOFT GAMMA-RAY SPECTRA EMITTED AFTER CAPTURE OF THERMAL NEUTRONS BY Cu^{63}, Cu^{65}, Ag^{107}, Ag^{109} AND In^{115}. V. V. Sklyarevskii, E. P. Stepanov, and B. A. Obinyakov. Atomnaya Energ. 5, 454-6(1958). Oct. (In Russian)

A scintillation spectrometer with NaI(Tl) crystal was used for measuring the spectra of soft γ rays produced by a thermal neutron capture in divided targets of isotopes of copper, silver, and indium and natural silver and copper. The values of γ-ray intensities of the latter are in good agreement with the results obtained for targets with isotopes. The suggested scheme of the lower levels of Ag^{108} and Ag^{110} and the table of energies and absolute γ-ray intensities produced in thermal neutron capture by Cu^{63}, Cu^{65}, Ag^{107}, Ag^{109}, and In^{115} nuclei are included. (R.V.J.)

3280

CROSS SECTION OF THE U^{238} (n, 2n) U^{237} REACTION FOR 15 Mev NEUTRONS. G. P. Antropov, Yu. A. Zysin, A. A. Kovrizhnykh, and A. A. Lbov. Atomnaya Energ. 5, 456-7(1958). Oct. (In Russian)

The cross section for the $U^{238}(n,2n)U^{237}$ reaction for 15-Mev neutrons developed by the authors in 1952 was compared with the cross section obtained by D. D. Knight et al. (Bull. Amer. Phys. Soc. ser. II. v. 2, 198, 1957) for neutrons with smaller energies, according to which the $\sigma(n,2n)$ increases sharply from 0 to 6 Mev up to $(1.4 \pm 0.14) \times 10^{-24}$ cm^2 at 10 Mev. The latter is close to the anticipated statistical theory value, where with

increasing neutron energy up to 14 to 15 Mev, the $\sigma(n,2n)$ value should remain constant and equal to $\sim 1.5 \times 10^{-24}$ cm^2. Hence, the cross section of $U^{238}(n,2n)U^{237}$ for 15-Mev neutrons agrees with the statistical theory and the described data. The recently published values for (n,2n) reactions on U^{238} for the fission spectrum neutrons equal to $(17 \pm 3) \times 10^{-27}$ cm^2 agree with the magnitudes which can be obtained by integrating $\sigma(n,2n)$ over the energy of the fission neutron spectrum. (R.V.J.)

3281

DISTRIBUTION OF NUCLEAR CHARGE IN THE PROTON-INDUCED FISSION OF Th^{232}. B. D. Pate, J. S. Foster, and L. Yaffe (McGill Univ., Montreal and Brookhaven National Lab., Upton, N. Y.). Can. J. Chem. 36, 1691-1706(1958) Dec.

The cross sections for the independent formation of I^{130}, I^{131}, Te^{131}, I^{132}, and I^{134} and for the cumulative formation of Te^{132}, I^{133}, and I^{135} in the proton-induced fission of Th^{232} were measured at nine proton energies from 8 to 87 Mev. From these data and from published total chain yield data, charge distribution curves were obtained. These are compared with published charge distribution curves for uranium fission at energies up to 480 Mev and together they show a shift of the most probable fission product charge toward stability and a widening of the distribution with increasing bombarding energy. These phenomena are interpreted in terms of current models for nuclear reactions. (auth)

3282

FISSION OF EXCITED HEAVY NUCLEI. B. D. Pate (Brookhaven National Lab., Upton, N. Y.). Can. J. Chem. 36, 1707-19(1958) Dec.

The results of published calculations on the prompt nuclear cascade and nuclear evaporation processes are combined with some assumptions regarding the nuclear fission process and fission widths to calculate the average neutron-to-proton ratios of fission products from Th + 8-Mev protons, Th + 87-Mev protons, and U + 450-Mev protons. Comparison of the results with experimental data indicates that the fission charge distribution mode characterized by the equal charge displacement hypothesis, hitherto considered a low energy phenomenon, persists in uranium and thorium up to the highest energy studied. There is also some evidence that fission occurs in excited heavy nuclei before complete de-excitation by particle emission, in agreement with other experimental work. (auth)

3283

ON THE ENERGY LEVELS OF NUCLEI IN THE NEIGHBORHOOD OF Pb^{208}. Min Yu (Inst. of Physics, Academy of China, Chinese Peoples Republic). Chzhungo kesyue, Scienta sinica 6, No. 3, 399-412(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1958, Abstract No. 7847.)

By using the Bruckner method through introducing the model factor, the low-lying energy levels of Po^{210} which has two excess protons compared with the Pb^{208} nucleus are computed. Use is made of the phase shifts of the nucleon-nucleon scattering processes. The boundary effects and Coulomb interaction of the protons are not considered. As a final result, a theoretical diagram is plotted for the levels of the Po^{210} nucleus, and its very close coincidence with the experimental data is emphasized.

3284

EMISSION OF FAST CHARGED PARTICLES IN THE REACTIONS BETWEEN 1-Bev PROTONS AND LIGHT NUCLEI. Georges Philbert and Leopold Vigneron. Compt. rend. 247, 1335-8(1958) Oct. 27. (In French)

The angular and energy distributions of fast protons are similar in the two types of interactions with light nuclei previously shown (Compt. rend. 247, 290(1958)). However, the emission of charged pions was considerably reduced with respect to emission in nucleon-nucleon interactions. (tr-auth)

3285

THE SPECTRA OF HIGH ENERGY COLLISION ELECTRONS FROM μ MESONS IN THE SUBSOIL. Madeleine Avan. Compt. rend. 247, 1584-7(1958) Nov. 10 (In French)

An experimental study was made of collision electrons created by μ mesons in discharge nuclear emulsions exposed and developed underground in an iron mine near Caen at three levels: −100, −300, and −580 m of water. The study showed a hardening of the integral energy spectra when the depth increased. (tr-auth)

3286

GAMMA ANGULAR DISTRIBUTIONS IN THE COULOMB EXCITATION OF SOME u-g NUCLEI. J. de Boer, M. Martin, and P. Marmier (Cyclotron-Laboratorium, Zürich). Helv. Phys. Acta 31, 578-80(1958). (In German)

The electromagnetic excitation of Eu^{153}, Gd^{157}, Dy^{163}, Hf^{177}, Hf^{179}, Re^{185}, and Re^{187} was investigated with 4-Mev protons. The energy, yield, and angular distribution of the decay gamma radiation was measured. The results are tabulated. (J.S.R.)

3287

INTERACTIONS OF 300-Mev NEUTRONS WITH Cu, Ag, AND Pt. Cl. Bovet, E. Jeannet, J. Rossel, and E. Vaucher (Univ. of Neuchâtel, Switzerland). Helv. Phys. Acta 31, 583-6(1958). (In French)

The stars produced by 300-Mev neutrons were studied by the emulsion sandwich method. The angular distribution of the tracks, the average number of branches per star, and the effective cross section for the production of stars were determined, and the results are tabulated. The average value of the number of branches per star decreases when A increases. The variation of the effective cross section increases for the transparent nucleus for increasing values of A. (J.S.R.)

3288

INVESTIGATIONS OF (γ,pn) AND (γ,d) REACTIONS WITH GAMMA ENERGIES UP TO 32 Mev. A. Hofmann and P. Stoll. Helv. Phys. Acta 31, 591-600(1958). (In German)

Photon induced two-particle emission was investigated with a 32 Mev betatron. The yields of the following (γ,pn) and (γ,d) reactions were determined: $Ca^{40}(\gamma,pn)K^{38}$, $Zn^{64}(\gamma,pn)Cu^{62}$, $Zn^{66}(\gamma,pn)Cu^{64}$, $Se^{80}(\gamma,pn)As^{78}$, $Mo^{92}(\gamma,pn)Nb^{90}$, and $Sb^{123}(\gamma,pn)Sn^{121}$. The cross section vs. photon energy relationship was measured for the reactions $Ca^{40}(\gamma,pn)K^{38}$ and $Zn^{66}(\gamma,pn)Cu^{64}$. The integrated cross section of the $Zn^{66}(\gamma,nn)Zn^{64}$ process is about double that of the $(\gamma,pn) + (\gamma,d)$ reaction on Zn^{66}. The value for the $Zn^{66}(\gamma,nn)$ reaction is calculated from statistical theory to be $\sigma_{Zn^{66}(\gamma,nn)} = 0.088$ Mev barn. The yield of $(\gamma,pn) + (\gamma,d)$ reactions together with the yield of (γ,α) and (γ,p) reactions was plotted as a function of nuclear charge. It is evident, that the $(\gamma,d + \gamma,pn)$ yields have the same shape as the (γ,p) reactions. (auth)

3289

DETERMINATION OF THE BETA RAY ENERGY SPECTRUM FROM THE ABSORPTION CURVES OF BETA RAYS. N. K. Saha and K. L. Kaila (Univ. of Delhi). Indian J. Phys. 32, 418-29(1958) Sept.

An attempt is made to calculate the energy-distribution of the β-ray spectrum of RaE starting from the observed absorption curve of these β-rays. The absorption law of homogeneous β-rays, required as the basis of this calculation, is obtained here by a rigorous curve fitting of the existing data. Further, Katz and Penfold's (K.P.) remarkable range-energy relation for β-rays is utilized, which seems to avoid most of the limitations of the earlier relations. Somewhat improved results compared to previous workers' are obtained in the present work, but still some divergence with the results of magnetic spectrograph remains. Possible causes of the divergence are discussed. (auth)

3290

ON THE ABSORPTION COEFFICIENTS AND ENERGY SPECTRA OF GAMMA-RAYS FROM Ra (B + C) UNDER THICK LAYERS OF Pb ABSORBER. P. K. Sen Chaudhury (Presidency Coll., Calcutta). Indian J. Phys. 32, 430-8(1958) Sept.

The absorption coefficients and energy spectra of gamma-rays from 500 mc of Ra in equilibrium were measured under thick layers of Pb from 18.5 to 27.5 cm with a sodium iodide (thallium activated) crystal in combination with a linear amplifier and differential energy discriminator. The absorption coefficient measured with absorber of very small lateral dimensions and for the gamma-rays of highest energy, e.g., 2.494 ± 0.073 Mev emitted by radium is about 8% less than the theoretical value. But when a strong and wide beam is used by placing the Ra source immediately below the absorber then the measured absorption coefficients show anomalous variations as previously reported by the author. The energy spectra measured under 18.5 cm and 20.5 cm of Pb absorber show three peaks at about 2.494 ± 0.073, 2.220 ± 0.065 and at 1.776 ± 0.052 Mev and the energy spectra under 23.5 cm shows in addition to these three peaks indications of another peak at 1.469 ± 0.043 Mev. (auth)

3291

RADIATION ENHANCED DIFFUSION IN SOLIDS. G. J. Dienes and A. C. Damsk (Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 29, 1713-21(1958) Dec.

A simple theory of radiation enhanced diffusion has been worked out which describes the dependence of this enhancement on flux and temperature under steady-state conditions. The theoretical study also shows that the measurement of enhanced diffusion as a function of temperature can indicate the mechanism by which defects are removed from the lattice. Alpha-brass was chosen for the experimental work because it is a kinetically simple system, not complicated by nucleation, in which diffusion is easily followed by measuring the electrical resistivity changes associated with changes in short-range order. The enhanced diffusion rate during irradiation in the Brookhaven reactor has been measured in this alloy at several temperatures in the range 0 to 190°C. This enhancement is independent of temperature from 0 to 150°C, in excellent agreement with the theoretical predictions for the case where the radiation induced defects finally disappear at internal surfaces. Some implications of radiation enhanced diffusion and suggestions for further study are also discussed. (auth)

3292

BRANCHING IN THE DECAY OF ^{97}Ru TO ^{97m}Tc AND ^{97}Tc. S. Katcoff and D. C. Williams (Brookhaven National Lab., Upton, N. Y.). J. Inorg. & Nuclear Chem. 7, 189-93(1958) Oct.

By comparing the K x-ray intensity of 90 day Tc^{97m} with the K x-ray intensity of the 2.88 day Ru^{97} parent from which it grew, we found that Ru^{97} branches 0.041 ± 0.005 per cent to Tc^{97m} and 99.96 per cent to Tc^{97}. Based on this measurement and data in the literature, a revised decay scheme is proposed for Ru^{97}. Analysis of fourteen decay curves showed a half-life of 2.88 ± 0.04 days for Ru^{97}. (auth)

3293

NEUTRON ACTIVATION CROSS-SECTIONS OF ^{96}Ru AND ^{102}Ru. S. Katcoff and D. C. Williams (Brookhaven National Lab., Upton, N. Y.). J. Inorg. & Nuclear Chem. 7, 194-6(1958) Oct.

Measurements of the activities of 2.88 day Ru^{97} and 39.7 day Ru^{103} from (n,γ) reactions on natural Ru showed that the thermal neutron activation cross-sections of Ru^{96} and Ru^{102} are 0.210 and 1.50 barns, respectively. The intensities of 2.70 day Au^{198} in gold monitors were used as standards. That Ru^{196} has at least one large resonance in the epithermal region is indicated by cadmium difference measurements. Duplicate runs were reproducible to about 3 per cent but the absolute accuracy is estimated as ±15 per cent. (auth)

3294

ELECTRON CAPTURE HALF-LIFE OF ^{243}Cm. G. R. Choppin and S. G. Thompson (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 7, 197-8(1958) Oct.

A sample containing Cm^{242} was milked for Am after a known growth period. From the relative activity intensities and mass ratios in the curium sample and the amount of Am^{243} which grew in, a value of $1.0 \pm 0.1 \times 10^4$ years was calculated for the electron capture half-life of Cm^{243}. (auth)

3295

THE SPECIFIC ACTIVITIES AND HALF LIVES OF AMERICIUM-241 AND AMERICIUM-243. J. C. Wallmann, Peter Graf, and Lilly Goda (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 7, 199-200(1958) Oc

The specific activities of one sample of Am^{241} metal and two samples of Am^{243} metal have been measured. Half-lives of 457.7 ± 1.8 years and 7951 ± 48 years, respectively, have been obtained. (auth)

3296

THE COVALENT RADIUS OF RADON AND THE ELECTRONEGATIVITIES OF GOLD, MERCURY, THALLIUM, LEAD, AND BISMUTH. R. T. Sanderson (State Univ. of Iowa, Iowa City). J. Inorg. & Nuclear Chem. 7, 288-90 (1958) Oct.

A new empirical approach is reported by which a new "nonpolar covalent" radon radius has been obtained. The inert elements conform to the relationship. $Z^{1/2} = 4.73\ N/r - 4.00$, where Z is the atomic number, N the principal quantum number of the outermost shell, and r the "nonpolar covalent" radius. A value of 2.14 A is obtained for radon. Another expression is also given from which a value of 2.12 A is obtained. The good agreement of the two methods suggest that the new radon radius should be preferable to the older value.

The value 2.14 corresponds to an average electronic density of 2.09. From this, interpolating between xenon and radon, revised electronegativities of Au, Hg, Tl, Pb, and Bi have been computed. (T.B.A.)

3297

THE BLOCH-SIEGERT EFFECT AND THE EFFECT OF AN ALTERNATING PERTURBATION FIELD IN MAGNETIC AND QUADRUPOLE RESONANCE. Francois Lurcat. J. phys. radium 19, 745-9(1958) Oct. (In French)

A method is given, which allows the study of the resonance frequency shift due to finite radiofrequency field amplitude, or to another field with a different frequency — starting from macroscopic equations. This method is applied to the computation of these shifts in the case of quadrupole resonance of nuclei with spins 1, 3/2 and 5/2. (auth)

3298

SCATTERING BY NUCLEAR FLUORESCENCE OF THE γ RADIATION OF Se^{75}. PERIODS OF THE 265-kev AND 402-kev LEVELS OF As^{75}. H. Langevin-Joliot and M. Langevin. J. phys. radium 19, 765-75(1958) Oct. (In French)

Nuclear resonance fluorescence from the 265 kev excited state of As^{75} leads to a value of $(2.3 \pm 0,3) \times 10^{-11}$ sec for the half life of this level. No resonance fluorescence from the 402 kev level was observed and the half life of this level is therefore greater than 1.4×10^{-11} sec. The variation of nuclear resonance intensity from the 265 kev level with the pressure of the gaseous source gives the value $(1.5 \pm 0,4) \times 10^{-9}$ sec for the half life of the 402 kev level. Electron capture branching ratios were reexamined and a weak (0.04%) new transition leads to the 575 kev level of As^{75}. (auth)

3299

EXCITED STATES OF Pt^{192}. Mitsuhiro Kawamura, Atsushi Aoki, and Takeo Hayashi (Saikyo Univ., Kyoto). J. Phys. Soc. Japan 13, 1071-6(1958) Oct.

The directional correlations of the 300 kev-300 kev, 468 kev-316 kev and 300 kev-600 kev gamma-gamma cascades in Pt^{192} have been measured by using the coincidence spectrometer reported previously. It is found that the spins of the 784 kev and 920 kev levels are 4 and 3, respectively. (auth)

3300

ANISOTROPY OF NUCLEAR MAGNETIC RESONANCE DUE TO CRYSTAL DISLOCATIONS. Eizo Otsuka (Osaka City Univ.). J. Phys. Soc. Japan 13, 1155-67 (1958) Oct.

Using plastically deformed crystals of KI, the nuclear magnetic resonance of I^{127} has been observed. The broadened signals of I^{127} show distinct anisotropy as regards the direction of the external magnetic field. This anisotropy is interpreted to arise from the definite orientation of a crystal dislocation. The experimental results are analyzed in terms of the gradient-elastic tensor which has been introduced by Shulman-Wyluda-Anderson. It is concluded that densities of edge and screw dislocations are fairly well balanced and increase for a certain range almost linearly with degree of cold-working, in agreement with the previously reported result for KBr. Assuming the total dislocation density to be 10^9 cm^{-2} for 10% deformation, a result is obtained of $|C_{44}| \sim 8 \times 10^4$ statvolts/dyne and its one-third for $|C_{11}|$. Comparison with the result for KBr shows that the amplification factor of eQq is greater than 50 for I^{127} in KI. (auth)

3301

NUCLEAR MAGNETIC RESONANCE STUDIES OF IODINE IONS IN AQUEOUS SOLUTION. Junkichi Itoh and Yukio Yamagata (Osaka Univ.). J. Phys. Soc. Japan 13, 1182-6(1958) Oct.

Chemical shift and line width were measured for the nuclear magnetic resonance of iodine nuclei in aqueous solutions of alkali iodides. The chemical shift was independent of temperature, but was dependent on the concentration of the solution. The spin lattice relaxation time calculated from the line width varied with temperature as well as concentration. General trend of the variation of the spin lattice relaxation time agrees with that of viscosity. By analyzing the data of the chemical shift and spin lattice relaxation time, it is suggested that even in very dilute solution there exists chemical shift of the order of 6×10^{-4} as compared to the case of 'pure ion.' (auth)

3302

NUCLEAR MAGNETIC RESONANCE EXPERIMENTS OF I^{127} IN KI. Junkichi Itoh and Yukio Yamagata (Osaka Univ.). J. Phys. Soc Japan 13, 1232-3(1958) Oct.

A series of experimental studies on nuclear magnetic resonance of alkali halides was made. The temperature dependence of the spin-lattice relaxation time and chemical shift of iodine nuclear magnetic resonance in KI crystals are reported. (auth)

3303

A PROPOSED EXPLANATION OF IRRADIATION GROWTH OF URANIUM. Ryukiti R. Hasiguti, Hideo Sakairi, and Tetuya Sugai (Univ. of Tokyo). J. Phys. Soc. Japan 13, 1233-4(1958) Oct.

It is observed that irradiation growth does not occur at low temperatures and at temperatures of 500°C. This is explained by the facts that diffusion and precipitation become slow at lower temperatures and that twinning does not take place at high temperatures. (auth)

3304

THE REACTION $F^{19}(d,n)Ne^{20}$ AND THE ENERGY LEVELS OF Ne^{20}. Susumu Morita and Kenji Takeshita (Kyushu Univ., Fukuoka, Japan). J. Phys. Soc. Japan 13, 1241-7(1958) Nov.

The energy spectra of neutrons emitted in the reaction $F^{19}(d,n)Ne^{20}$, produced by the 2.17 Mev deuteron, were measured with nuclear plates disposed at angles of 0 to 165 degrees, with respect to the incident deuteron, at intervals of 15 degrees. The general features of the spectra were consistent with the evaporation model. From these spectra, the energy levels of Ne^{20} were found at excitation energies of 1.74 ± 0.03, 4.20 ± 0.04, 4.96 ± 0.05, 5.62 ± 0.04, 6.80 ± 0.01, 7.16 ± 0.09, 7.41 ± 0.05, 7.90 ± 0.04, 9.15 ± 0.04 and 10.01 ± 0.03 Mev. Some evidences for the existence of new levels at 0.65 ± 0.04, 2.53 ± 0.07, 8.32 ± 0.03, 8.71 ± 0.01 and 9.50 ± 0.04 Mev were also obtained. The Q-value for the ground state transition was determined to be 10.81 ± 0.03 Mev. The angular distributions of the neutrons leading to the ground state and the lowest four excited states, with exception of the uncertain states, were obtained and compared with the stripping theory. The agreement is not very good. The relative values of total cross sections for each neutron group were estimated. (auth)

3305

DIFFERENTIAL ELASTIC SCATTERING OF 14 Mev NEUTRONS IN ALUMINUM, IRON, LEAD AND BISMUTH FOR LARGE ANGLES. Kazunori Yuasa (Konan

Univ., Kobe, Japan). J. Phys. Soc. Japan 13, 1248-58 (1958) Nov.

The absolute differential cross sections for the elastic scattering of 14 Mev neutrons in Al, Fe, Pb, and Bi have been measured for large angles up to 170°. The neutrons generated by $^3T(d,n)^4He$ reactions were scattered by the disk-shaped scatterer, and counted by the n–α coincidence circuit with the resolving time of 4 ns. An anti-coincidence method was used to reduce the accidental coincidences between the α-particles and the neutrons which run directly to the detector from the target. Except for the lighter nucleus, the angular distributions obtained fit fairly well with distributions based on the optical model theory employing a surface imaginary part and a real spin-orbit coupling term. (auth)

3306

SPIN QUENCHING AND MAGNETIC RESONANCE. Tôru Moriya (Tokyo Metropolitan Univ.) and Yukio Obata (Univ. of Tokyo). J. Phys. Soc. Japan 13, 1333-44(1958) Nov.

The effect of the magnetic ions of those paramagnetic salts whose spin degeneracy is completely lifted by the combined action of the spin-orbit coupling and the crystalline electric field, on the magnetic resonance of nuclear spins and electronic spins of other kind of ions such as Cu^{2+}, Co^{2+}, Mn^{2+} substituted for the host ions are studied theoretically. General formulas for the resonance field shift, line width and the thermal relaxation time in nuclear (or electron) spin resonance in magnetic substances are given. T_1 and T_2 are here related to the difference between isothermal and isolated susceptibilities. Temperature dependence of T_1 and T_2 as well as magnetic field dependence of them are studied. At low temperatures they become longer rapidly (exponentially) as temperature is lowered while at high temperatures they are independent of temperature. Field dependence of the line width is of the type of $H_i^2 + H$ when the line is narrowed by spin-spin interaction among the host ion spins, or $\sqrt{H_0^2 + H_i^2}$ when the line is not narrowed, where H_i denotes the local magnetic field. Field dependence of $1/T_1$ is always like $H_0^2 + H_i^2$. The theoretical results are compared with some available experimental data on electron spin resonance. The agreement between theory and experiment seems to be not unreasonable as far as order of magnitude and qualitative characters of the line width are concerned, though experimental data are now rather scanty. (auth)

3307

NUCLEAR MAGNETIC RESONANCE OF TRANSITION ELEMENTS IN PARAMAGNETIC SALTS. Tôru Moriya (Tokyo Metropolitan Univ.). J. Phys. Soc. Japan 13, 1344-52(1958) Nov.

Nuclear magnetic resonance of transition elements in paramagnetic salts under two situations is studied theoretically. One is the case where the magnetic ions have no Kramers degeneracy and their spin degeneracy is completely lifted by the combined action of the spin-orbit coupling and the crystalline electric field. Another is the case of the ideal paramagnetic substances under a strong magnetic field and at low temperatures. The resonance field (or frequency) shift, the relaxation times T_1 and T_2 due to hyperfine interaction and the indirect nuclear spin coupling via electron spins are calculated. The results show that the nuclear resonance of transition elements in paramagnetic salts is expected to be observable under favorable conditions. (auth)

3308

(γ,p) REACTIONS IN Na^{23}, K^{39}, I^{127} AND Cs^{133}. L. Keszthelyi and J. Ero (Central Research Inst. for Physics, Budapest). Nuclear Phys. 8, 650-60(1958) Nov. (2)

Proton spectra of $K^{39}(\gamma,p)Ar^{38}$, $Na^{23}(\gamma,p)Ne^{22}$, $I^{127}(\gamma,p)Te^{126}$ and $Cs^{133}(\gamma,p)Xe^{132}$ reactions have been investigated by irradiating KI(Tl), NaI(Tl) and CsI(Tl) crystals by Li(p,γ) gamma rays, and the corresponding cross sections have been determined. Electron background was reduced by placing a guard crystal in front of the target crystal. Approximate cross sections are 15 ± 5.8 mb for $K^{39}(\gamma,p)$; 3.6 ± 1.5 mb for $Na^{23}(\gamma,p)$ and 1.5 ± 0.6 mb for $I^{127}(\gamma,p)$ and $Cs^{133}(\gamma,p)$ reactions at 17.6 Mev γ-energy. The proton spectrum of $K^{39}(\gamma,p)$ reaction shows peaks at 6.1, 9.2 and 11 Mev corresponding to the 5, 2.15 and 0 Mev levels of Ar^{38}. The $I^{127}(\gamma,p)$ and $Cs^{133}(\gamma,p)$ spectra are inconsistent with the statistical theory owing to the effect of direct interaction. (auth)

3309

THE CHARACTERISTIC LEVEL AND THE NUCLEAR LEVEL DENSITY. M. El-Nadi and M. Wafik (Egyptian Atomic Energy Commission, Cairo). Nuclear Phys. 9, 22-31(1958-59) Nov. (3).

The suggestions put forward by Bethe and Hurwitz that level densities ought to be measured from a standard energy, such as is given by the semi-empirical formula, and not from nuclear ground states is considered. The semi-empirical formula is corrected, following P. Fong, and this "characteristic level" is determined for nuclei from A = 10 to A = 250. The experimental data of D. Hughes et al. for the fast neutron cross sections are used to determine the level densities for the corresponding nuclei. These were found to be in agreement with the Fermi-gas model. (auth)

3310

THE NUCLEAR PHOTOEFFECT IN Al^{27}. F. Ferrero, R. Malvano, S. Menardi, and O. Terracini (Univ. of Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuclear Phys. 9, 32-43(1958-59) Nov. (3).

Experimental results are reported concerning the photoneutron cross sections obtained in different ways. These results are discussed and compared with the predictions of the independent particle model. Some discrepancies that appeared in previous measurements have been clarified, whereas some others still remain unexplained. (auth)

3311

SPINS OF BISMUTH ISOTOPES OF MASSES 203, 204, 205 AND 206. C. M. Johansson and I. P. K. Lindgren (Univ. of Uppsala). Nuclear Phys. 9, 44-8(1958-59) Nov. (3).

A six-pole focusing atomic beam apparatus has been used for the measurement of the ground state spins of four neutron–deficient bismuth isotopes. The experimental results are: for 12h Bi^{203}, $I = 9/2$; for 13h Bi^{204}, $I = 6$; for 14.5d Bi^{205}, $I = 9/2$; for 6.3d Bi^{206}, $I = 6$. (auth)

3312

ON THE INELASTIC SCATTERING OF NUCLEONS BY NUCLEI AT HIGH ENERGIES. H. S. Köhler (CERN, Geneva). Nuclear Phys. 9, 49-64(1958-59) Nov. (3).

The inelastic scattering of high-energy nucleons by nuclei has been treated taking account of the nuclear distortion of the scattered wave in the high-energy approximation. Using the collective model and includ-

ing a Thomas-type spin-orbit interaction, treated as a perturbation, the explicit expression for the polarization previously obtained for elastic scattering is generalized to inelastic scattering as well. The many-body problem of inelastic scattering is considered following the methods of Watson et al. This treatment is limited to transitions for which the two-nucleon scattering matrix is reduced as it is in elastic scattering on spin-zero nuclei. Then an explicit expression for the polarization is again derived similar to that for the elastic scattering but reflecting the angular dependence of nucleon-nucleon scattering. (auth)

3313

DECAY OF Eu^{152m}. Ingvar Marklund (Inst. of Physics, Uppsala). Nuclear Phys. 9, 83-7(1958-59). Nov. (3).

The decay of Eu^{152m} (9.2h) is investigated by means of coincidence measurements. The γ energies and intensities are measured with a crystal spectrometer and a double-focusing iron yoke spectrometer. Results: 121.78, 344.3, 841.6, 963.3, 970.3, 1315.0, and 1389.3 kev. (auth)

3314

PREDICTIONS OF THE DISTORTED WAVE THEORY OF DEUTERON STRIPPING REACTIONS. R. Huby, M. Y. Refai (Univ. of Liverpool) and G. R. Satchler (Clarendon Lab., Oxford). Nuclear Phys. 9, 94-107 (1958-59) Nov. (3).

The distorted wave theory of stripping is presented in a general form, and the degree of generality is examined. The spin polarization of (d,p) protons and the correlation function of de-excitation γ rays are expressed on this theory as functions of statistical tensors ρ_{kq} which can in principle be calculated given the details of the process (wave functions, interaction potential etc.). The form of the polarization and correlation are investigated, and it is shown what features of these are characteristic of the theory in general as distinct from its details. In this way experimental tests are devised to find whether observed results are compatible with stripping theory of this type. The tests consist in relations predicted between observed "experimental parameters." The cases l = 1 and 2 (l = orbital angular momentum of captured nucleon) are discussed fully. (auth)

3315

THE DECAY OF ^{73}Ga. C. Ythier (Univ. of Strasbourg), R. K. Girgis, R. A. Ricci, and R. Van Lieshout (Inst. voor kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 9, 108-15(1958-59) Nov. (3).

The isotope Ga^{73} was produced by fast neutron and deuteron bombardments of natural and enriched germanium; the decay was studied with scintillation and absorption techniques. The half life is 4.85 ± 0.10 hours; there are two beta branches of 1.19 (94%) and 0.4 (≈6%) Mev. Three gamma rays of 0.295, 0.745, and 1.04 Mev have been found, the first one of which is in coincidence with the higher energy beta group. A decay scheme is proposed. (auth)

3316

ON THE REARRANGEMENT ENERGY OF NUCLEAR MATTER. P. Mittelstaedt (CERN, Geneva). Nuclear Phys. 9, 116-23(1958-59) Nov. (3).

The extent to which the rearrangement energy of nuclear matter can be explained by the Brueckner two-body cluster approximation is investigated. Using the formalism of Gomes, Walecka, and Weisskopf, it is shown that the exclusion principle and the requirement of self-consistency lead to a rearrangement energy. The contributions to the rearrangement energy due to higher cluster corrections are discussed by comparing the results so obtained with the phenomenological data. These higher order corrections are found to be relatively unimportant, in disagreement with the critique of the Brueckner theory recently put forward by Hugenholtz and van Hove. (auth)

3317

SINGLE PARTICLE RADIATION TRANSITION IN THE OPTICAL MODEL OF THE NUCLEUS. F. Beck (Univ. of Munich). Nuclear Phys. 9, 140-62(1958-59) Nov. (3). (In German)

Using the "distorted wave approximation" and employing for the nuclear interaction a complex square well potential, the single particle contribution to the radiative capture of neutrons incident on a medium weight nucleus is calculated. Numerical results are obtained for the upper end of the γ spectrum, $d\sigma(n,\gamma)/dE_\gamma$, for an incident energy of 20 Mev, and for the integrated cross section, $\sigma(n,\gamma)(E_n)$, in the energy region 10 Mev $\leqq E_n \leqq$ 20 Mev. These results agree fairly well with experimental data on (p,γ) reactions, available in this energy region, and a closer agreement of the integrated cross section is obtained by adding to the single particle part the compound nucleus contribution for the process in question. The radiation from compound nucleus states contributes a non-negligible amount up to about 15 Mev incident energy. The presence of an absorbing part in the potential does not change the order of magnitude of the cross section compared to the value obtained in a real potential, up to an absorption strength of V_1 = 10.5 Mev. (auth)

3318

ON THE CALCULATION OF THE Y_{40} DEFORMATION IN STRONGLY DEFORMED HEAVY NUCLEI. Kerstin Kjällquist (Univ. of Lund). Nuclear Phys. 9, 163-77 (1958-59) Nov. (3).

The equilibrium Y_{40} deformation in strongly deformed heavy nuclei is calculated, treating the Y_{40} term as a small perturbation of a spheroidal potential, characterized by a comparatively great Y_{20} deformation. The equilibrium deformation is determined from the condition that the deformation of the potential and of the nuclear density calculated from the wave equation with this potential shall be equal. Numerical values are given for even isotopes of Th, U, Pu, Cm, Cf, Fm. (auth)

3319

ENERGY DISCRIMINATION IN GAMMA-DOSE EVALUATION. L. F. Kocher (General Electric Co., Richland, Wash.). Nucleonics 16, No. 11, 151, 153-4, 156(1958) Nov.

Two methods that can be used to evaluate gamma doses measured with multiple-shield film dosimeters are (a) simultaneous equations in the case of x- and γ-ray exposures of known energies and (b) constant-density curves in the case of multiple-energy exposures. Some examples are given of the application of these methods to energy-discrimination studies with Du Pont 502 film packets. (auth)

3320

THE MECHANISM OF NEUTRON EMISSION IN HIGH ENERGY FISSION. D. M. Skyrme and G. N. Harding (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuovo cimento (10) 9, 1082-4(1958) Sept. 16.

A measurement has been made of the energy spectrum of neutrons evaporated from uranium bombarded with 150 Mev protons, using nuclear emulsion technique. The mean kinetic energy of the neutrons is found to be (2.4 ± 0.2) Mev. (auth)

3321

VLASOV INSTABILITY IN LONGITUDINAL PLASMA OSCILLATIONS. Peter L. Auer (General Electric Co., Schenectady, N. Y.). Phys. Rev. Letters 1, 411-13(1958) Dec. 1.

It is concluded from the sizable currents computed that Vlasov instabilities of the simple type considered will not play a major role in the problem of magnetic confinement and attendant diamagnetic currents. The situation investigated may have a valid application to the plasma of the sun's corona and possibly the simple types of Vlasov instabilities have some connection with solar prominences. (T.B.A.)

3322

GAMMA-RAY BRANCHING AND SOME SPIN AND PARITY ASSIGNMENTS IN B^{11}. A. J. Ferguson, H. E. Gove, et al. (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can.). Phys. Rev. Letters 1, 414-15(1958) Dec. 1.

In this set of experiments each level of the γ spectrum, obtained principally from the $Be^9(He^3,p\gamma)B^{11}$ reaction, was separated from the others by coincidences measured with the appropriate proton group. Many of the branching ratios are in excellent agreement with Kurath's theoretical values if the spin-orbit coupling parameter has a value near 4.5. The M1 matrix element for the $^7/_2^- \rightarrow {}^5/_2^-$ transition vanishes so that the strong E2 transition of the 6.76-Mev state to ground state compared with the M1 transition to the 4.46-Mev state is quite reasonable. The E2/M1 amplitude ratio of the 4.46-Mev γ ray deducted from its angular distribution is 0.14 ± 0.01 compared with Kurath's 0.21. The 5.03-Mev and 7.30-Mev branching agrees with the tentative assignments $^3/_2$-* and $^5/_2$-*, respectively. The * indicating the second state of spin and parity. (T.B.A.)

3323

A MEASUREMENT OF THE NEUTRON-PROTON CAPTURE CROSS-SECTION. A. R. Baker (Cambridge Univ., Eng.). Proc. Roy. Soc. (London) A248, 539-59 (1958) Dec. 9.

Measurements have been made of the neutron density as a function of distance from a polonium-beryllium source in effectively infinite tanks of water and aqueous boric acid. The ratio of the thermal-neutron capture cross sections of boron and hydrogen was found to be 2317 ± 27. The cross section of hydrogen calculated from this result, using the known cross section of Harwell standard boron, 769 ± 4 barns (at a neutron velocity of 2200 m/s.), and the known cross section of the boron used relative to Harwell standard boron, 0.985 ± 0.002, was 0.327 ± 0.004 barn (at 2200 m/s.) which is consistent with other recent accurate values. In preliminary experiments, it was shown that flux measurements reproducible to better than 3% were possible with the disks of Ilford C2 nuclear research photographic emulsion used as detectors. The main source of error in the result was the statistical error for a total count of 200,000 tracks. The only corrections necessary were 1.6% for recoil proton background, and 0.7% for the disturbance of the neutron density by the detectors. (auth)

3324

RIGIDITY FOR OCTUPOLE TYPE SURFACE INFORMATION AND SHELL STRUCTURE. Shota Suekane and Wataro Watari (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 108-10(1958) July.

The surface rigidity of closed shells for an octupole type of surface deformation was calculated using a method similar to that of Marumori, Suekane, and Yamamoto (Progr. Theoret. Phys. (Kyoto) 16, 320 (1956)). The results are shown graphically. (L.T.W.)

3325

A NOTE ON THE SPECIFICATION OF NUCLEAR POTENTIALS. Tetsuo Hamada (Univ. of Sydney). Progr. Theoret. Phys. (Kyoto) 20, 114-15(1958) July.

Expressions for Gaussian, exponential, and Yukawa wells have been given by Blatt and Jackson (Phys. Rev. 76, 18 (1949)) using numerical constants determined by numerical integration of the Schroedinger equation for zero energy. More accurate values of the numerical constants have been calculated using a fast computer and are reported. (L.T.W.)

3326

ELECTROMAGNETIC PROPERTIES OF NUCLEONS. Akira Kanazawa, Shinya Furui, and Tetsuro Sakuma (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 20, 149-62(1958) Aug.

The current and the magnetic moment of the nucleon are calculated, starting from a relativistic one nucleon formalism. It is shown that the relativistic corrections are very important for the current and the magnetic moment of the nucleon, especially for the vector part of the former and the scalar part of the latter, where the effects of the recoils are of the same order as those given by the static model. The numerical result, obtained by means of Chew's method, shows that the neutron current and the scalar part of the magnetic moment may be consistent with the experiment by choosing suitably the coupling constant ($g^2/4\pi = 0.08$ or 0.10) and the cut-off momentum ($k_{max} = 5\mu$, 6μ, or 7μ). However the effect of the nucleon recoil to the vector part of the moment is destructive and gives a definitely smaller value than the empirical one. It is also shown that the renormalized charge is equal to the unrenormalized charge in our approximation which contains only the terms up to the order of 1/M. (auth)

3327

ON THE EXCHANGE MAGNETIC MOMENTS. Eiichi Kuroboshi and Yasuo Hara (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 163-70(1958) Aug.

The exchange magnetic moment operators for the two-nucleon system are obtained in terms of photopion production matrix elements. This photopion production part is closely related with the pion-nucleon scattering part, thus enabling one to use π-N scattering experimental values in the expressions of the exchange magnetic moment operators. These formulas are applied to cases of triton magnetic moment and those of heavy nuclei (the Fermi gas model). In the former case, rather a good result is obtained, while in the latter it is found that exchange magnetic moments can explain only small parts of the deviations from the Schmidt lines. (auth)

3328

PROTON-PROTON SCATTERING AND PION THEORY OF NUCLEAR FORCES. Shoichiro Otsuki (Nagoya

Univ., Japan). Progr. Theoret. Phys. (Kyoto) 20, 171-80 (1958) Aug.

In order to explore reliable consequences of the pion theory of nuclear forces at high energies, the p–p scattering at 90 Mev is discussed in detail. No evidence has been found to show that the static pion-theoretical potential is appreciably modified up to 100 Mev. This conclusion is in conflict with the prediction of very strong spin-orbit coupling potentials recently made by Signell and Marshak and by Gammel and Thaler. Especially, it is discussed that the former spin-orbit term was introduced in reliance on Gartenhaus' potential at small inter-nucleon distances. These spin-orbit coupling potentials are unreasonably strong from the pion-theoretical view-point. Importance of the $^3P_2$–$^3F_2$ coupling parameter in determining angular distributions is pointed out. (auth)

3329

NEUTRON-PROTON SCATTERING AND PION THEORY OF NUCLEAR FORCES. Wataro Watari (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 181-91 (1958) Aug.

The n-p scattering at 90 Mev is discussed in detail. Around this energy phase shifts with $L \geq 2$ are almost completely determined by the one-pion-exchange potential. Phase shifts with L = 1 should be qualitatively determined by the pion theory. Phase shifts with L = 0 must be determined phenomenologically. Using P-wave phase shifts obtained by Otsuki from the p-p scattering data, scattering parameters in the (J = 1)-states from the n-p scattering analysis were determined. N-p polarizations are analyzed, and some sets of phase shifts with J = 1 which are consistent with the experiments are determined. Using thus determined phase shifts, angular distributions are calculated and compared with experimental data. Thus it is found that the static pion-theoretical potential can reproduce n-p experimental data at 90 Mev without any serious modifications. (auth)

3330

EFFECTS OF VIRTUAL NUCLEON PAIRS TO THE ELECTROMAGNETIC STRUCTURE OF THE NUCLEON. Shigeo Goto and Shigeru Machida (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 216-38(1958) Aug.

Effects of virtual nucleon pairs on the electromagnetic structure of the nucleon are calculated covariantly in the charge independent pseudoscalar meson theory. A rigorous expression for the vertex operator is derived which is strongly reminiscent of the old-fashioned first- and second-order perturbation theory. The method of approximation is to replace the complete set of eigenfunctions of the total Hamiltonian by some suitable functions, which are chosen so as to take into account the main contribution from the virtual nucleon pairs. These effects are proved, regardless of the magnitude of the coupling constant, to reveal themselves only through the renormalization factors, which affect the relative magnitudes of the isotopic scalar and vector parts of the nucleon-current contributions and the meson-current contributions. Numerical results are almost the same with those obtained by cutting off the momentum integration at the nucleon mass in the second order perturbation calculation both for the ratio of the anomalous magnetic moments of the proton and the neutron and the mean-square radii of the charge distributions. (auth)

3331

A REMARK ON THE ANOMALOUS MAGNETIC MOMENT IN THE STATIC MODEL. Yasuo Hara and Ken Kawarabayashi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 252-4(1958) Aug.

3332

MESONIC ATOMS. D. West (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Repts. Progr. in Phys. 21, 271-311(1958).

The properties of mesonic atoms are described. The information which can be deduced about the properties of the π and μ mesons and their interactions with the nucleus is summarized. Experimental results on the nuclear size, meson masses and the π meson-nucleon interaction which have been obtained from a study of the energy levels are discussed. The experimentally determined yields of K and L series x-rays also give information on the processes of de-excitation of mesonic atoms. In particular there is evidence of collision de-excitation which is related to meson transfer in compounds and the formation of mesonic molecules which is observed in liquid hydrogen. Other properties of mesonic atoms at present beyond the reach of experimental investigation are briefly mentioned. (auth)

3333

INELASTIC SCATTERING CROSS SECTIONS OF 3.6 Mev NEUTRONS BY ATOMIC NUCLEI. V. A. Batalin and N. S. Kopytin (Inst. of Physics, Academy of Sciences, Ukrainian SSR.). Ukrain. Fiz. Zhur. 3, 185-9 (1958) Mar.-Apr. (In Ukrainian)

Measurements of the inelastic scattering of 3.6-Mev neutrons on C, Na, Al, Fe, Zn, Se, Zr, Cd, Sn, Sb, Te, I, Pb, Bi, and NaCl are presented. The inelastic cross sections were determined by the sphere transmission method. The threshold detector was a scintillation detector with ZnS(Ag) phosphor. The threshold sensitivity of the detector was determined by the excitation function of the $S^{32}(n,p)P^{32}$ reaction. The neutron source was the $D(d,n)He^3$ reaction. The deuterons were accelerated by an electrostatic generator. Measurements were corrected for energy loss due to elastic scattering and for two inelastic collisions. The results are given in a table. The investigations showed that the cross sections of inelastic scattering increase steadily with the atomic weight. Deviation from the increase was found at the Zr, Pb, and Bi nuclei. (tr-auth)

3334

CROSS SECTIONS OF INELASTIC INTERACTIONS OF 14 Mev NEUTRONS WITH ATOMIC NUCLEI. V. I. Strizhak, A. P. Yaremik, and V. V. Kravtsov (Inst. of Physics, Academy of Sciences, Ukrainian SSR.). Ukrain. Fiz. Zhur. 3, 190-5(1958) Mar.-Apr. (In Ukrainian)

Cross sections of 14-Mev neutron inelastic interactions with C, N, Al, Fe, Zn, Cd, Sn, Hg, Pb, and Bi were measured with a stiblene crystal and photomultiplier. The dependence of the transmission magnitudes on the detector threshold was determined. (tr-auth)

3335

RADIUS OF DISTRIBUTION OF NUCLEAR CHARGE AND BINDING ENERGY OF NUCLEUS. Tszin'-yan Tszen (Peking Univ.). Uli syuebao, Acta phys. sinica 13, No. 5, 357-64(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1958, Abstract No. 7794.)

On the basis of an analysis of experimental data

(scattering of high-energy electrons and x-ray spectra of μ-mesonic atoms), it is concluded that the radius of the distribution of the nuclear charge R_p corresponds very well to the relation $Z^{1/3}$ on the atomic number, instead of the usual relation $R_p \sim A^{1/3}$. Under this assumption, the semi-empirical equation for the mass was modified. The term with the Coulomb energy is considered in the form $\frac{3}{5}Z^2e^2/r_0Z^{1/3}$. The agreement between the binding energies of the nuclei, calculated according to this new formula, with the experimental data is better than in the case of the old Bethe-Weizsaecker formula. The new formula predicts very accurately also the mass numbers of most β-stable nuclei.

3336

INVESTIGATION OF THE ENERGY SHADING AND THE EFFECTIVE CROSS SECTIONS OF (n,α) PROCESSES CAUSED BY THERMAL NEUTRONS. Fritz Minnich (Univ. of Erlangen, Ger.). Z. Physik 153, 106-23(1958). (In German)

Reactions with thermal neutrons were known only in light nuclei up till now. In the present work, such reactions in elements with average atomic numbers were detected in nuclear photographic plates. The thermal neutrons were produced by slowing fas neutrons from a Ra—Be source in paraffin. (n,α) reactions were detected in the isotopes S^{32}, S^{33}, Ca^{40}, Ni^{58}, and Ni^{61}. The Q values and the effective cross sections were experimentally determined. The values were also theoretically estimated. The agreement is satisfactory in consideration of the rude estimation. The results are tabulated. (tr-auth)

3337

FISSION OF SILVER NUCLEI INDUCED BY HIGH ENERGY PROTONS. V. P. Shamov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 316-21(1958) Aug. (In Russian)

Some parameters relating to fission of silver nuclei induced by protons possessing energies between 300 and 660 Mev are investigated. An analysis of the experimental data shows that the fission of silver nuclei induced by high-energy protons predominantly leads to the formation of fragments of equal masses. The fission cross section does not significantly vary in the investigated energy range of the incident protons and is $\sigma_f = (3.2 \pm 1)\ 10^{-28}$ cm^2. As a rule fission is accompanied by the emission of a large number of charged particles which indicates that the initial degree of excitation of the fissioning nuclei is quite large. The complete curve for the yield of residual nuclei as a function of charge is presented and also the differential yield curves for various nuclear interaction processes such as fragmentation, fission, and the cascade-evaporation process. (tr-auth)

3338

INVESTIGATION OF 15 TO 65 Mev PROTONS PRODUCED IN THE PHOTODISINTEGRATION OF Al AND Ni. E. B. Bazhanov, Yu. M. Volkov, and L. A. Kulchitskii (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 322-7(1958) Aug. (In Russian)

Angular distributions of photoprotons from Al and Ni were investigated for a peak bremsstrahlung energy $E_{\gamma\ max} = 85$ Mev, and the energy distributions of photoprotons from Al were studied for angles of 30°, 90°, and 130° for $E_{\gamma\ max} = 90$ Mev. Results are discussed from the viewpoint of the quasi-deuteron mechanism of interaction between γ quanta and nuclei. (tr-auth)

3339

EFFECT OF FINITE NUCLEAR DIMENSIONS ON THE RELATIVE INTERNAL CONVERSION COEFFICIENTS IN L-SUBSHELLS. A. G. Sergeev, V. D. Vorob'ev, et al. (Leningrad Inst. of Transportation). Zhur. Eksptl'. i Teoret. Fiz. 35, 348-54(1958) Aug. (In Russian)

The relative conversion coefficients in L subshells were measured for three pure M1 transitions: 46.5 kev in Bi^{210} and 115.1 and 238.6 kev in Bi^{212}. It is shown that in order to obtain agreement between the experimental data and theoretical calculations of the L conversion coefficients the finite dimensions of the nucleus should be taken into account. The ratios L_I: L_{II}: L_{III} for the M1 transitions of 277.3 kev in Pb^{205} were also measured. (tr-auth)

3340

PHOTOPRODUCTION OF SLOW π^0 MESONS ON COMPLEX NUCLEI. A. S. Belousov, S. V. Rusakov, and E. I. Tamm (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 355-63(1958) Aug. (In Russian)

Measurements of the dependence of the cross section for slow π^0 meson photoproduction on the atomic number of the target nuclei are presented for nuclei between C and Pb. For peak synchrotron γ-ray energies of 265 and 210 Mev $\sigma \sim A^{2/3}$. The dependence of the yield of slow π mesons on the maximal γ-ray energy was measured for carbon and lead. The results agree with the theory of production of π mesons on the surface of the nucleus. (tr-auth)

3341

ROTATIONAL STATES OF NONAXIAL NUCLEI. A. S. Davydov and G. F. Filippov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 440-7(1958) Aug. (In Russian)

A theory for the energy states and electromagnetic transitions between them is developed for nuclei which do not possess axial symmetry. It is shown that violation of axial symmetry of the nucleus may not appreciably change the rotational states of axial nuclei but leads to the appearance of new energy states. Comparison of the theory with experiment indicates that the so-called γ-vibrational energy levels of even-even nuclei should be regarded as rotational levels. The levels of some nuclei with a sequence of spins 0,2,2,3 should be ascribed to the same type. (tr-auth)

3342

NUCLEAR STRUCTURE DEFLECTIONS FROM AXIAL SYMMETRY. D. A. Zaikin (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 529-30(1958) Aug. (In Russian)

The experimental data on nuclear levels indicated a lack of axial symmetry in a series of nuclei. Studies were undertaken in order to determine the behavior of nucleons in a potential field without axial symmetry. (R.V.J.)

3343

THE MEAN YIELD OF NEUTRONS IN Th^{229} FISSION BY THERMAL NEUTRONS. V. I. Lebedev and V. I. Kalashnikova. Zhur. Eksptl'. i Teoret. Fiz. 35, 535-7 (1958) Aug. (In Russian)

The ν (Th^{229}) was expressed using the known value of

ν (U^{235}). The ratio of neutrons emitted in a single slow neutron fission of Th^{229} and U^{235} is expressed as ν (Th^{229})/ν (U^{235}) = 0.864 ± 0.008; considering ν (U^{235}) = 2.47 ± 0.03, the value ν (th^{229}) = 2.13 ± 0.03 is obtained. (R.V.J.)

3344

NUCLEAR POLARIZATION IN K-CAPTURE RADIATION. V. B. Berestetskii. Zhur. Eksptl'. i Teoret. Fiz. 35, 537-8(1958) Aug. (In Russian)

Investigations show that the pseudovector < J > is proportional to the photon pulse vector, and the photon emission takes place with conservation of parity. In fact, the nuclear polarization is determined by the polarization of the absorbed virtual electron. (R.V.J.)

3345

NUCLEAR RECOIL TRACKS OF Na^{24} AND MECHANISM OF NUCLEAR REACTIONS Al^{27}(p,3pn), Si^{28}(p,4pn), AND P^{31}(p,5p3n) WITH 660 Mev PROTONS. L. V. Volkova and E. P. Denisov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 538-9(1958) Aug. (In Russian)

3346

ON THE ABSORPTION OF SLOW π MESONS BY NUCLEI. A. T. Varfolomeev (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 540-1(1958) Aug. (In Russian)

A special case of π-meson capture by Be^9 in the reaction $Be^9 + \pi^- \rightarrow Li^8 + n$ was investigated in an attempt to determine the influence of nucleon collective interactions on the mechanism of the initial π^- meson rest energy distribution. The spallation according to the reaction indicates that nucleon collective interactions play an important part in the slow π-meson absorption processes. Investigations with wider range "stars" confirmed the conclusion. (R.V.J.)

3347

RECOIL TRACKS OF Na^{24} AND MECHANISMS OF CERTAIN PHOTONUCLEAR REACTIONS. F. P. Denisov and P. A. Cherenkov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 544-6(1958) Aug. (In Russian)

Measurements were made of Na^{24} recoil tracks formed in photonuclear reactions of Al, Si, P, and S. The experiments with Al were made at bremsstrahlung maximum energies ($E_{\gamma\ max}$) equal to 80, 100, 150, 200, and 260 Mev, and for Si, P, and S at $E_{\gamma\ max}$ = 260 Mev. Mean effective thicknesses for the Na^{24} nuclear recoil at $E_{\gamma\ max}$ = 260 Mev in the reactions Al^{27}(γ,2pn), Si^{28}(γ,3pn), P^{31}(γ,4p3n), and S^{32}(γ,5p3n) are tabulated. (R.V.J.)

3348

LOW EXITATION LEVELS OF Th^{231}. Yu. I. Filimonov and B. V. Pshenichnikov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 548-9 (1958) Aug. (In Russian)

The Th^{231} γ-ray spectrum was studied with a scintillation spectrometer with a NaI(Tl) crystal and 7% resolving power on the Cs^{137} line. Gamma quanta coinciding with U^{235} α particles were recorded, and the spectra obtained are plotted. The most intense line on the spectrum corresponds to 184 kev. The intensity of the 144-kev line is 25 to 30% that of the 184-kev line. The intensity of unresolved lines in the spectrum from 70 to 110 kev is 40% of the intensity of the line at 184 kev. (R.V.J.)

3349

SEPARATION OF THE NUCLEAR ISOMERS Hg^{195} AND Hg^{197}. V. D. Nefedov and E. N. Sinotova (Zhdanov Leningrad State Univ.). Zhur. Fiz. Khim. 32, 2392-7 (1958) Oct. (In Russian)

A method was developed for separating the nuclear isomers Hg^{195} and Hg^{197}. It was established that Hg^{195m} is formed through the reaction Hg^{196} (n,2n) Hg^{195m} on irradiating mercury in a reactor with fast neutrons. (tr-auth)

3350

NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY. SOLID STATE PHYSICS, SUPPLEMENT 1. T. P. Das and E. L. Hahn. New York, Academic Press Inc., 1958. 229p.

This review emphasizes the pure nuclear quadrupole interactions with crystalline and molecular electric fields. An attempt was made to relate the theory, applications, and important examples of nuclear quadrupole studies and to present this information in a systematic fashion. (W.L.H.)

Theory

3351 NP-6995

Laboratório da Producao Mineral, Rio de Janeiro and Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

BEZIEHUNGEN ZWISCHEN KLASSISCHEN UND RELATIVISTISCHEN INVARIANZOPERATIONEN. (Relation Between Classical and Relativistic Invariance Operations.) H. Zocher, C. Török, and G. Beck. 1958. 14p. (Notas de Física, Vol. IV, No. 1).

It is shown that the symmetry properties of the physical magnitudes with respect to time in classical physics correspond to the invariance of basic equations under time reversal. This invariance can not be derived directly from the corresponding relativistic equation because of the characteristic indeterminability of the latter, depending on the appearance of ambiguous functions, which also lead to apparent contradictions regarding the periodic symmetry functions. There is no difficulty in finding a general invariance property of the relativistic equations which guarantee the periodic symmetry properties of the classical theory also in the area of the relativistic theory. The ambiguity of the relativistic magnitudes leads to new invariance properties which are connected with the production of antiparticles and the appearances of kinds of pair production, and whose role is still not clarified in a satisfactory manner. (tr-auth)

3352

UNIFIED THEORY OF NUCLEAR REACTIONS. Herman Feshbach (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.) 5, 357-90(1958) Dec.

A new formulation of the theory of nuclear reactions based on the properties of a generalized "optical" potential is presented. The real and imaginary part of this potential satisfy a dispersion type relation while its poles give rise to resonances in nuclear reactions. A new derivation of the Breit-Wigner formula is given in which the concept of channel radius is not employed. This derivation is extended to the case of overlapping resonances. These results can then be employed to obtain the complex potential well model for pure elastic

scattering. This potential well is shown to become real as the average width of the resonances increases. Reactions as well as elastic scattering are treated. Considering the former process in an isolated resonance, we obtain a nonresonant term analogous to the familiar potential scattering term of elastic scattering. This is just the direct interaction term which thus appears automatically in this formalism. Upon performing the appropriate energy averages over resonances, the complex potential well model is generalized so as to include inelastic scattering. The effects of the identity of nucleons is investigated. It is shown that our formalism is valid as long as the exit channels can at most contain one nucleon. (auth)

3353

BASIS OF THE KINETIC THEORY AND THE BOLTZMANN EQUATION. CASE WHERE THE FLUID IS SUBJECTED TO A FORCE FIELD. Simone Marquet. Compt. rend. 247, 1319-22(1958) Oct. 27. (In French)

A system of n particles is described by a measurement on its extension in phases. An equation of evolution is described for this measurement. Under certain very general conditions, this equation is resolved, and the properties of its solution are studied. (tr-auth)

3354

BASIS OF THE KINETIC THEORY AND THE BOLTZMANN EQUATION. CASE WHERE THE FLUID IS SUBMITTED TO A FORCE FIELD. II. Simone Marquet. Compt. rend. 247, 1445-8(1958) Nov. 3. (In French)

In a preceding article (Compt. rend. 247, 1319-22 (1958)), a system of n particles was described by a measurement of radon. An equation of evolution for this measurement was proposed and resolved. By an asymptotic conservation theorem of corpuscular inorganization, a Boltzmann equation and a method for its resolution can be derived from the evolution equation. (tr-auth)

3355

RESOLUTION OF THE ENERGY OF THE PHOTONUCLEAR GIANT RESONANCE FOR DEFORMED NUCLEI. Michel Fabre de la Ripelle. Compt. rend. 247, 1568-71(1958) Nov. 10. (In French)

An equation is derived which gives the separation of the two resonance energies for deformed nuclei. The theoretical results are compared with experimental results for Ta^{181} and the agreement is good. (J.S.R.)

3356

A REMARK ON FERMI INTERACTIONS. Takehiko Takabayasi. Compt. rend. 247, 1571-4(1958) Nov. 10. (In French)

Equations are derived which describe the annihilation and simultaneous creation of fermions. (J.S.R.)

3357

ON THE POSSIBILITY OF PREFERENTIAL ACCELERATION OF HEAVY ELEMENTS IN COSMIC RAY SOURCES. A. A. Korchak and S. I. Syrovatskii (Lebedev Inst. of Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 792-4(1958) Oct. 11. (In Russian)

Possibilities of preferential acceleration of heavy nuclei is examined using an example of statistical acceleration mechanism. Moreover, it is shown that conditions favorable to preferential acceleration of heavy elements may exist in the cosmic radiation sources. (R.V.J.)

3358

A UNIFIED THEORY OF THE FERMI INTERACTIONS. Toshiyuki Toyoda (CERN, Geneva). Nuclear Phys. 8, 661-74(1958) Nov. (2)

A method developed by Infeld and van der Waerden for generalizing the free Dirac field equation into the scheme of general relativity is used to unify the interaction types by adding some new hypotheses but still remaining in the usual Minkowski space. An explanation for a modified Pauli-Gürsey transformation is given in relation with the coupling types. Neither conventional isospinspace nor strangeness quantum number are used, but only the usual three dimensional spin space is necessary. The results seem to be similar to those of the Feynman—Gell-Mann theory except for a few points. A comparison with their theory is made. (auth)

3359

SERIES EXPANSIONS AND VARIATIONAL METHODS FOR THE ENERGY OF A SYSTEM OF FERMIONS. R. J. Eden (CERN, Geneva). Nuclear Phys. 9, 65-73(1958-59) Nov. (3).

The relation between a variational method and a formally complete perturbation series for the energy of a finite system of fermions is studied. If certain assumptions about convergence are valid, the variational method minimizes the size of the sum of correction terms in the perturbation series at the point of self-consistency determined from the leading term in this series. Away from self-consistency the sum of the correction terms becomes large. Although the first few correction terms appear to represent surface energies, their sum gives a volume energy. The usual method of defining an infinite medium corresponds to a limiting process which throws away the dominant correction terms except possibly at the point of self-consistency. The limiting process elsewhere violates the conditions under which the formal series for the energy corresponds to an eigenvalue of the Schroedinger equation. (auth)

3360

EQUIVALENT HAMILTONIAN OF AN ELECTRON GAS AT HIGH DENSITY. Toshiyuki Nishiyama (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 20, 245-6(1958) Aug.

Recently Wentzel presented a method of the equivalent Hamiltonian of an electron gas based on Sawada's theory. In this theory the Bloch interaction has been adopted as the interaction between electrons and phonons together with the mutual Coulomb interaction with electrons in the explicit form. If the Bloch interaction is assumed, the mutual interaction of electrons should be of a screened form. If the mutual interaction is assumed in the explicit Coulombic form, the attractive Coulomb potential should be adopted as the interaction between electrons and ions in place of the Bloch interaction. Some modification becomes necessary to derive physically meaningful results. Wentzel's equivalent Hamiltonian is very similar to the Hamiltonian of coupled oscillators previously proposed. Both for an electron gas and for an electron-pion plasma it can be shown that results derived from the one are in fair agreement with those from the other. (A.C.)

3361

SPECTRAL REPRESENTATION OF THE TWO-MESON GREEN'S FUNCTION. V. N. Gribov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 35, 416-27(1958) Aug. (In Russian)

A spectral representation of the two-meson Green's function was obtained which is similar to that derived previously for the vertex part. The analytic properties of the function are examined. It follows from these representations that dispersion relations for the scattering amplitude exist for a given scattering angle in the cms. These relations are obtained and discussed. (tr-auth)

3362

ON THE DISPERSION RELATIONS IN NONRELATIVISTIC SCATTERING THEORY. L. D. Faddeev (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 433-9 (1958) Aug. (In Russian)

It is proposed that the dispersion equations for the scattering amplitude on a potential be deduced by studying the Green's function of the total hamiltonian. The method is illustrated for the case of a three-dimensional nonrelativistic equation for scattering on a fixed center, the relations previously obtained by Wong and Huri being strictly obtained in this manner. The existence of the dispersion relations is related to the problem concerning the complete characteristic for the S matrix for various equations for scattering on a potential. (tr-auth)

3363

GENERALIZED EQUATIONS WITH A SELF-CONSISTENT FIELD. P. S. Zyryanov (Ural Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 448-51(1958) Aug. (In Russian)

The Hartree equations extended to the case of nonstationary states are modified so as to include short-range scattering of particles as a sort of momentum interaction. The connection between these equations and the theories of Landau and Silin is demonstrated. On the basis of the generalized equations, dispersion relations for Fermi and Bose systems of interacting particles are derived. (tr-auth)

RADIATION EFFECTS ON MATERIALS

3364 ANL-5873

Argonne National Lab., Lemont, Ill.

THE CALCULATION OF RADIAL TEMPERATURE DISTRIBUTIONS IN CYLINDRICAL FUEL SPECIMENS DURING NEUTRON IRRADIATION. Metallurgy Program 6.1.26. Frank R. Taraba. Nov. 1958. 26p. Contract W-31-109-eng-38. $0.75(OTS).

A knowledge of the temperature distribution within a fuel sample during irradiation is required in order to evaluate the changes that occur in the physical and metallurgical properties of a fuel material upon irradiation. Because it is often impractical to measure temperatures within a fuel sample during irradiation, it is frequently necessary to rely upon computed values of the temperature. Therefore, a brief description and a comparison of the methods most frequently used for computing radial temperature distributions within irradiation samples are presented. The calculation of temperature distributions in samples containing fissionable isotopes is complicated by a number of variables, among which are the variation of heat production throughout the sample (due to local neutron-flux perturbations) and the variation of thermal conductivity occasioned by unusually steep temperature gradients. Various assumptions, which are considered to fit most closely the conditions at hand, are made for these calculations. As no standard set of assumptions can fit all cases, four illustrative cases are presented, representing four different sets of conditions applied to the heat-conduction equation. The four cases considered may be briefly described as follows: variable thermal conductivity, nonuniform heat production; variable thermal conductivity, uniform heat production; constant thermal conductivity, nonuniform heat production; and constant thermal conductivity, uniform heat production. (auth)

3365 HW-57903

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RECOVERY OF LATTICE EXPANSION OF IRRADIATED MOLYBDENUM. D. L. Gray. Nov. 1, 1958. 16p. Contract W-31-109-Eng-52. $0.50(OTS).

The lattice expansion of commercial molybdenum, irradiated at an average temperature of 35°C to various total fast neutron exposures from 6.5×10^{16} to 2.3×10^{19} nvt, was measured by x-ray-diffraction. The increase in cell dimensions was 0.011% at the lowest exposure and 0.041% at the highest exposure. Upon annealing the lattice expansion, three thermal recovery processes were noted: one at 100 to 200°C, one near 400°C, and one from 500 to 800°C. The first process, which annealed 20 to 30% of the total radiation induced lattice expansion, is grossly characterized by first order kinetics but a unique activation energy was not determined. This process is believed to represent trapping of interstitials by small impurity atoms. The 500 to 800°C process, which removes the largest part of the lattice expansion, is characterized by an activation energy of 2.5 ± 0.5 ev. (auth)

3366 NARF-58-1T(Add.5)

Convair, Fort Worth, Tex.

RESULTS OF SYSTEM PANELS TEST NUMBER 2. Addendum 5. Sept. 6, 1958. 177p. Project No. 6(1-9964). Contract AF-33(600)-32054. (FZK-9-126-5).

The results of this investigation indicate that some of the characteristics of the reinforced plastic laminates tested improved, some remained constant, and others were harmed by the mixed flux environment of gamma radiation (20×10^6 roentgens) and neutrons (3.5×10^{14} neutron/cm^2). Three jet fuels irradiated as part of the test program underwent small changes in composition commensurate with total dose but a major decrease in thermal stability. The degrading effect of the combined neutron-gamma flux appears to be mainly due to the gamma flux level and possibly to solution of iron. A wide variety of synthetic oils (esters, hydrocarbons, and silicones) were irradiated during the test to determine their sensitivity to reactor radiation. Results are included. The effects of nuclear radiation on the tear resistance characteristics of 2024-T81 and 7075-T6 aluminum alloys and type 422 corrosion-resistant steel were investigated. The low-level irradiation had no detectable effect upon the tear resistance of these materials. Two standard and three experimental types of chaff were irradiated statically. These samples received a total dose of 2.0×10^7 r and a total flux of 2×10^{14} nvt. There was no noticeable radiation damage to the chaff itself. A Bendix aircraft brake assembly was irradiated statically. The assembly was exposed to an average integrated neutron flux of 5.5×10^{14} n/cm^2 and a gamma dose of 6×10^6 r. No radiation damage was detected after this exposure. Two oils and one fuel were irradiated. The oil and

fuel samples were subjected to an integrated neutron flux of 1.2×10^{14} n/cm^2 and a gamma dose of 1×10^7 r. A selection of sealants, elastomeric materials, fabrics, plastics, wire insulation, finishes, bonded metal, and thermal insulation material along with corrosion test samples and a simulated seaplane hull bottom were irradiated statically. Radiation damage was detected in the sealants, elastomeric materials, fabrics, and wire insulation. (W.L.H.)

3367 NARF-58-48T

Convair, Fort Worth, Tex.

RADIATION DAMAGE TO METAL-BONDED AND SANDWICH PANELS. II. EFFECTS OF RADIATION ON HEXCEL 91LD AND HEXCEL F-120 HONEYCOMB CORE REINFORCED WITH FIBERGLAS. R. R. Bauerlein. Dec. 17, 1958. 14p. Project No. 6(1-9964). Contract AF33(600)-32054. (MR-N-163-2).

In an experiment to investigate the effects of radiation on the compressive strength of honeycomb cores, samples of Hexcel 91LD and Hexcel F-120 honeycomb core, each reinforced with Fiberglas, were irradiated with the Ground Test Reactor. Specimens were irradiated at ambient temperature at four different radiation levels with the maximum being a gamma dose of 9.3×10^9 ergs/gm and an integrated fast-neutron flux of 1.2×10^{15} n/cm^2. Within the statistical accuracy of the tests, the compressive strength of neither type of honeycomb core was found to be adversely affected by the irradiation. (auth)

3368 NP-7100

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 18 [ON RADIATION EFFECTS DATA]. Dec. 15, 1958. 33p. Project No. 2133. Contract AF33(616)-5171.

3369 NYO-7962

Carnegie Inst. of Tech., Pittsburgh.

IONIC CONDUCTIVITY OF GAMMA IRRADIATED SODIUM CHLORIDE (thesis). Herbert Smith Ingham, Jr. Sept. 1958. 124p. Contract AT(30-1)-1828. $19.80 (ph OTS); $6.30(mf OTS).

Single crystals of NaCl were subjected to about 5×10^5 roentgens of gamma irradiation from Co^{60}, at 5°C, and then rapidly heated and maintained at a fixed temperature in the range 65 to 135°C. The d-c ionic conductivity at this temperature was measured as a function of time. The experimental technique was to apply voltage to a crystal and measure current by means of a vibrating reed electrometer with known input resistance. The conductivity decreased in the temperature range 65 to 80°C during a period of several hours to a value that was less than the pre-irradiation conductivity by a factor which was typically about 30. The conductivity is presumed to be a direct measure of the number of positive ion vacancies. The data fit a rate equation describing the bimolecular process A + B → AB, with an activation energy approximately equal to that of the mobility of the positive ion vacancies. This seems to confirm the supposition that the change of conductivity reflects the clustering of the positive ion vacancies with other imperfections at a rate controlled by the diffusion of these vacancies. Above 100°C, many of the clusters appear to break up again. (auth)

3370 RDB(W)TN-182

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

SURVEYING GRAPHITE DISPLACEMENTS IN THE WINDSCALE PILES. D. Powell. 1958. Date of MS. Nov. 1954. 8p. (WTSC/R-190).

A simple apparatus was evolved by means of which the vertical distortion produced in the isotope channels due to Wigner growth may be measured. Some results are presented, and recommendations are made for future experiments. (auth)

3371

THE INFLUENCE OF STRUCTURE AND PROPERTIES OF URANIUM ON ITS BEHAVIOR UNDER IRRADIATION. A. S. Zaimovskii, G. Ya. Sergeev, V. V. Titova, B. M. Levitskii, and Yu N. Sokurskii. Atomnaya Energ. 5, 412-20(1958). Oct. (In Russian)

Tests showed that composition and working conditions (deformations in α phase and thermal treatment) can alter the radioinduced deformations in uranium specimens. Studies were made of radioinduced changes in the uranium crystal grain, stability, and yield in relation to the content of iron, silicon, and aluminum. It was found that radiation accelerates the uranium yield about 50 to 100 times ($nv = 6 \times 10^{12}$ neutron/cm^2 sec), i.e., in the order of 1.5 to 2.0 for textured and disoriented structures. The yield rate of uranium specimens with disoriented structure is related to the rate of the burnout. The expansion properties of uranium were tested directly in the reactor, and results showed that the relative elongation was reduced and stability was improved after the specimen was in the neutron field for 1 hour. (tr-auth)

3372

DIMENSIONAL STABILITY OF URANIUM–CHROMIUM ALLOYS. M. C. Fraser, G. A. Last, and S. H. Bush (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 4, 794-7(1958) Dec.

The effect of various additions of chromium from 0 to 1 at.% was investigated, covering the solid-solubility region of chromium in alpha uranium at room temperature. The experiment was designed to hold grain size and type and degree of preferred orientation constant while varying the chromium content with concomitant changes in the tensile properties. Two ingots, one unalloyed uranium and the other α uranium–0.90 at.% chromium alloy, were fabricated under different conditions. The objective was to produce a uranium specimen with a preferred orientation approximately the same as that in the uranium–1.00 at.% chromium alloy, and conversely a uranium–1.00 at.% chromium alloy with a preferred orientation as low as the normal uranium specimen. In this manner, a separation of the relative effect of preferred orientation and mechanical properties upon dimensional stability could be effected. The properties of these alloys were determined by chemical, metallographic, mechanical, x-ray, and dilatometric measurements. Significant properties are tabulated. An examination of the data indicates that the basic variables of grain size and preferred orientation were reasonably well controlled. An examination of the changes in dimensions of the specimens disclosed that all preferredly oriented samples increased in length and decreased in diameter. The results of the experiment are inconclusive insofar as correlating chromium level, orientation, or mechanical or physical properties with irradiation-induced dimensional stability. (A.C.)

3373

RADIATION PROCESSING OF FOODS IN BRITAIN. B. Coleby and M. Ingram (Low Temperature Research

Station, Cambridge, Eng.) and T. Horne and S. Jefferson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nucleonics 16, No. 11, 188, 190, 192, 194, 196-7(1958) Nov.

Food irradiation studies conducted in Britain are discussed. The radiation facilities consist of Co^{60} sources, spent fuel elements, 4-Mev linear accelerator, and a 2-Mev Van de Graaff machine. It has been found that sterilizing doses of radiation will only be of value for a small number of foods where quality changes are not easily detected. Such processing offers a unique treatment for frozen whole egg. No solution has been found to the quality-changing problems encountered in milk sterilization. Smaller doses are promising for prolonging the storage life of meat, fruit, and vegetables, and for grain disinfestation. (T.B.A.)

3374

THE EFFECTS OF RADIATION ON SOLIDS. H. G. Van Bueren, A. H. Cottrell, J. Heijboer, and G. Mayer. Gravenhage, Netherlands, Reactor Centrum Nederland, 1957. 77p. (In English and Dutch)

A series of four articles are presented on the effects of radiation on solids. Lattice imperfections in crystals are discussed as a general introduction to the characteristic properties of physical point and line imperfections such as can occur in irradiated metallic, ionic, and valence crystals. Ionizing radiations dissipate most of their energy in solids by exciting electrons. The effect of ionizing radiation on organic high polymers is discussed from the fundamental point of view. The effects of fast neutrons on some physical properties of graphite are described. (J.S.R.)

RADIOACTIVE WASTE

3375 AERE-E/R-2707

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

OPTIMUM CONDITIONS FOR THE USE OF VERMICULITE IN THE DECONTAMINATION OF RADIO-ACTIVE EFFLUENT. T. D. Wright and J. Monahan. Oct. 1958. 16p. $0.35(BIS).

It is shown that the ion exchange efficiency of vermiculite (a natural magnesium aluminosilicate) is impaired by the precipitation of magnesium hydroxide in the exchanger matrix when considering the removal of radioactive isotopes from effluent at pH 11.5 to 12.0. Experiments are described which show that this deficiency can be overcome by either of the following operations: conversion of the vermiculite to the sodium form prior to use; neutralization of the column influent to pH 7.0. It is concluded that the former method is the better, both from an economic and practical point of view. (auth)

3376

RADIOACTIVE WASTES RESULTING FROM THE PEACEFUL OR MILITARY UTILIZATION OF ATOMIC ENERGY. Claude Paoletti and A. Delaud. Age nucléaire No. 6, 33-43(1957) Sept.-Oct. (In French)

The peaceful or military utilization of atomic energy leads to the accumulation of radioactive wastes. These waste products consist of heavy natural radioactive elements, radioactive elements induced by neutrons, and radioactive elements resulting from the fission of nuclear fuel. The primary radioactive elements in each of these categories are discussed. A comparison is made of the radioactivity resulting from an atomic bomb and that caused by a nuclear reactor. The quantities of radioactive wastes that will be produced in the future are discussed and possible dangers are reviewed. 43 references. (J.S.R.)

REACTORS

General

Refer also to abstracts 3459, 3460, 3465, and 3467.

3377 AECU-3895

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDIES OF REACTOR CONTAINMENT. Combined Monthly Progress and Financial Status Report No. 18. T. A. Zaker. Nov. 7, 1958. 7p. ARF Project D132. Contract AT(11-1)-528. $1.80(ph OTS); $1.80(mf OTS).

Progress is summarized for each of the eight tasks of the program. The statement of financial status for the program is given. (For preceding period see AECU-3850.) (W.L.H.)

3378 AECU-3929

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE RESPONSE OF A WATER BOILER REACTOR TO VERY FAST POWER TRANSIENTS AND LINEARLY INCREASING REACTIVITY INPUTS. R. K. Stitt, E. L. Gardner, J. H. Roecker, and R. E. Wimmer. WATER BOILER EXCURSIONS WITH AN INITIALLY FILLED CORE. D. L. Hetrick. Sept. 3, 1958. 18p. Contract AT-(11-1)-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

A report is made on the Kinetic Experiment on Water Boiler Program. The purpose of this program is to examine the dynamic behavior of homogeneous research reactors to obtain the information necessary for the evaluation of the nuclear safety of such reactors. Step inputs of reactivity were systematically increased, and the first test core, a spherical core designed for stable power operation at 50 kw, was examined under conditions of 4% reactivity release. This is the maximum normally installed in such reactors. A 4% reactivity release places the reactor on a 2 millisecond stable period and leads to a peak power of 530 Mw. This represents the fastest intentional power excursion of any thermal reactor. The reactivity released is more than twice that which any other has withstood without damage. The maximum pressure in the system for this transient was a sharp pressure peak of 370 psia. This pressure is well below that required to cause yield of a typical water boiler core. (A.C.)

3379 AERE-M/L-2(2nd. Ed.)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MANUFACTURE OF DIDO FUEL ELEMENTS. H. Lloyd. Aug. 1958. 19p.

Text of paper given at the Symposium on Fuel Elements, Paris, November 1957.

The fuel charge for DIDO consists of 25 fuel elements. The square box section, usually termed the fuel box, is an assembly of ten fuel plates separated to form coolant channels. Each fuel plate contains 10 g of U^{235} in a

uranium–aluminum alloy which is clad in aluminum. The manufacture of these fuel elements is divided into fuel plate fabrication and fuel element assembly. The plates are made by the "picture frame" technique, where fuel cores are first prepared from an enriched uranium–aluminum alloy and fitted into aluminum frames which are then sandwiched between aluminum cladding plates to form "fuel packs." The fuel element is fabricated from four sub-assemblies: the fuel box, tube with guide nose, fin assembly, and nozzle tube assembly. (A.C.)

3380 AERE-RP/R-1788

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

EXPONENTIAL EXPERIMENTS WITH ENRICHED URANIUM–NATURAL WATER SYSTEMS. W. G. Davey and K. R. E. Smith. Oct. 1955. Decl. Mar. 4, 1957. 46p.

An account is given of the experimental technique and results of a series of enriched uranium–natural water experiments. (auth)

3381 BMI-1291

Battelle Memorial Inst., Columbus, Ohio.

SHIELDING-RESEARCH AREA AT BATTELLE. Walter R. Morgan, Harold M. Epstein, James N. Anno, Jr., and Joel W. Chastain, Jr. Sept. 18, 1958. 30p. Contract W-7405-eng-92. $0.75(OTS).

The design and construction of the shielding facility at Battelle are described. This facility consists of an open pool with a fission plate, an instrument bridge and tower, a control room, and radiation-detection instruments. The shielding pool is located at the end of the thermal column of the Battelle Research Reactor (BRR). The fission plate is 28 in. in diameter and contains approximately 3.5 kg of U^{235}. The plate was fabricated from three pieces of highly enriched U and clad with about 25 mils of 2S Al. It generates about 24 w during steady-state reactor operation. The fission spectra of neutrons and gamma rays produced by the fission plate are free from appreciable background radiations. The ratio of thermal to epithermal neutrons impinging upon the fission plate is approximately 67, indicating a low fast-neutron background. Assuming an average energy of 2 Mev for background gamma rays results in a ratio of thermal-neutron flux to gamma flux of 16. (auth)

3382 GMR-100

General Motors Corp. Research Staff, Detroit.

INSTRUCTION MANUAL FOR THE NUCLEAR REACTOR CODES SYSTEM MAGNUM. C. B. Leffert. [1958]. 30p.

The reactor code system, MAGNUM, consists of the basic one dimensional, multigroup, neutron diffusion code, GNU, and the various attendant routines programmed for the IBM 704. Instructions for the use of GNU and its attendant routines are presented. Although some modifications of instructions are expected with further development, the programs for GNU and most of the attendant routines are essentially fixed. A brief description of each of the programs now available, together with detailed instructions for providing the necessary input data for the successful operation, is included. (auth)

3383 HW-57376

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE EFFECT OF HELIUM SOLUBILITY IN WATER ON AN EMERGENCY SHUTDOWN OF THE PRTR. R. W. Moulton. Sept. 10, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

The calculations indicate that on an emergency shutdown, with loss of primary coolant circulation, the helium solubility will show a marked decrease between ten and fifteen minutes after the initiation of the scram. The decrease in solubility, if equilibrium is assumed, will release 4.0 cubic feet of gas at the conditions existing in the primary coolant system. This quantity of helium, if trapped at the high point in the system, could establish a gas block that could not be overcome by natural convection circulation. Slowing or stopping of the circulation would cause the coolant to boil in the process tube. However, with all of the process tubes connected in parallel, it is difficult to predict accurately the conditions in a particular tube and it is recommended that further consideration be given to this problem. A properly scheduled variation in total pressure on emergency shutdown could prevent the helium release indicated above. It is recommended that this be given consideration in planning the reactor operation. Another effect of the change of helium solubility with temperature is that in normal operation passage or primary coolant through the process tubes with attendant heating causes a reduction in the helium solubility. This amounts to a value of 7.4% void fraction at the outlet of the process tubes if equilibrium is assumed. (auth)

3384 HW-57418

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF HEAT TRANSFER TO TOP SHIELD ASSEMBLY OF THE PRTR. R. W. Moulton. Sept. 11, 1958. 2p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Equilibrium temperature levels at various points in the top shield assembly of the PRTR during normal operation were evaluated. The calculated results are presented. (J.R.D.)

3385 NAA-SR-2953

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ANALYSIS OF NEUTRON FLUX IN THE SHIELDING OF THE SODIUM REACTOR EXPERIMENT. F. L. Fillmore and R. J. Doyas. Oct. 15, 1958. 30p. Contract AT-11-1-GEN-8. $1.00(OTS).

The development of a matrix method of solving multigroup diffusion equations in nonmultiplying regions is described. The method is applied to a three-region shielding problem, and comparison is made with experimental results. Equations obtained by this technique can be solved with a desk calculator. (auth)

3386 NP-7042

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

UNIVERSITY OF FLORIDA TRAINING REACTOR HAZARDS SUMMARY REPORT. J. M. Duncan. Oct. 1958. 124p.

Available as Eng. Progr. Univ. Florida 12, Bull. Ser. No. 99. This report supersedes AECU-3688.

A report on the location, design, and hazards analysis of the University of Florida training reactor has been submitted to the Atomic Energy Commission as a part of the University's application for a class 104 license and construction permit for a 10-kw training reactor. The reactor will be used primarily for the training and education of graduate students in nuclear science and

engineering. The basic element of the reactor is a rectangular prism (5 ft × 5 ft × 4 ft) constructed of graphite bars. The fissionable material is introduced into the graphite prism in the form of Al–U alloy plates in six Al boxes, each of which contains a small amount of water. The prism of graphite is surrounded by a shield of concrete made partly of barytes and ordinary concrete and partly of concrete blocks. The reactor is housed in a cell having monolithic concrete walls and a precast, light-weight, concrete roof deck sealed with tarred felt and pitch with a slag covering. A control room and records office is located in one corner of the cell. A storage place for the fuel plates when not in use is provided in the floor near the reactor. The cooling system is integrated with the building structure. In addition to the design description, a detailed safety analysis is presented. (L.T.W.)

3387 NRL-4495(Del.)
Naval Research Lab., Washington, D. C.
TRANSIENT RESPONSE OF PLANE PARALLEL FUEL ASSEMBLIES TO EXPONENTIAL POWER EXCURSIONS. S. E. Golian, T. A. Bergstralh, E. G. Harris, and R. C. O'Rourke. Jan. 1955. Decl. with deletions July 11, 1956. 73p.

An exploratory mathematical analysis is made of the thermal conditions resulting from the application of an exponential power excursion to a plane parallel type fuel element immersed in water. For excursion periods in the region of interest, below 30 milliseconds, the coolant is considered as completely stagnant until such time as boiling point temperatures are attained. The first portion of the report considers thermal predictions for temperatures up to the boiling point. For an exponential power excursion it is well known that the temperature rise at any given point of the system will, after an initial period containing starting transients, settle down to a quasi-steady state having an exponential rise of the same time dependence as the heat input. Two methods of physical interpretation may be used for this quasi-steady state: (1) Two points of the system will attain a given temperature rise at two different times; this may be considered as a delay due to propagation time of a thermal state. In the quasi-steady state this delay will be a function of the relative position of the two points and will be independent of time. (2) At a given time the temperatures of the two points will have increased by different amounts; this may be interpreted as due to a spatial attenuation. In the quasi-steady state the difference of temperature increases will vary with time, while the ratio of temperature increases will be a constant. The time delay and spatial attenuation, which are functions of geometry, thermal constants, and period of the excursion, are calculated for a number of fuel element types. Curves are presented for the variation of central fuel temperature rise and instantaneous reactor power as a function of the clad-coolant interface temperature rise for various excursion periods. The error involved in the quasi-steady state assumption is discussed and the complete solution without this assumption is given for one case. The effect of ambient temperatures is considered. Beyond the boiling temperature point some elementary assumptions are made as to the mechanism of shut-off. Under optimistic assumptions, predicted peak power and fuel center temperatures at shut-off time are calculated for a number of cases of non-pressurized systems. The results of these calculations are compared to published experimental results of the Borax tests. A reasonable agreement is found for the excursion periods of greatest interest. A qualitative comparison is made of expected thermal transient phenomena under various initial pressure conditions. (auth)

3388 NYO-2332
American Hydrotherm Corp., Long Island City, N. Y.
POTENTIAL APPLICATIONS OF NUCLEAR ENERGY FOR PROCESS AND SPACE HEAT IN THE UNITED STATES. Paul L. Geiringer and Morton J. Goodfriend. Oct. 1958. 267p. $2.75(OTS).

A survey and analysis of the potential opportunity for the use of nuclear reactors to satisfy process and space heat requirements in the continental United States and Alaska has been completed. The greatest emphasis has been devoted to manufacturing industries that utilize large quantities of process heat and therefore may be considered possible future users of heat-generating reactors. These heat-using installations are limited to those geographic areas where the economies of current reactor operation appear to provide present or future inducement when compared with conventional heating plants. Analysis of delivered steam costs derived from conventionally-fueled boiler installations in locations in the United States is presented herein, together with a discussion of the various factors to be considered in both types of heating plants, in order to determine the competitive threshold for nuclear heating. It is concluded that, insofar as heat requirements and present fossil fuel costs are involved, an appreciable opportunity exists for nuclear heating, particularly in the northern states and those bordering on either coast. (auth)

3389 NYO-7922
Aeroprojects, Inc., West Chester, Penna.
INVESTIGATION OF ULTRASONIC POTENTIALITIES IN FLUID FLOW PROMOTION. N. Maropis, J. B. Jones, and C. D. Twardowski. June 1958. 45p. Contract AT(30-1)-1836. $7.80(ph OTS); $3.30(mf OTS).

A need for improved circulation in homogeneous reactor fuel systems, which would avoid complex canned rotor pumps and mechanical seal leakage problems associated with mechanically moving parts, led to a feasibility study of acoustic radiation as a means to augment ordinary convection. A survey of the literature is discussed, and exploratory experiments with a liquid acoustic simulant in a vessel approximating the LAPRE II reactor are described. Fluid streaming velocities of about 5 to 8 in./sec were achieved with power requirements in a practical range. It was concluded that convection velocities in natural convection reactors can be augmented but the magnitude thereof involves superimposing acoustic streaming on thermally induced convection, which requires further investigation; cavitation erosion of the acoustic radiating face and concomitant contamination of the nuclear fuel should present no great problems. (auth)

3390 ORNL-2562
Oak Ridge National Lab., Tenn.
OPERATION OF THE ORNL GRAPHITE REACTOR AND OF THE LOW-INTENSITY TEST REACTOR AND PRE-OPERATIONAL WORK ON THE ORR. Annual Report for 1957. J. A. Cox and W. R. Casto. Compiled from reports by C. D. Cagle, C. B. Gaither, W. H. Tabor, and T. C. Weeks. Dec. 9, 1958. 29p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The ORR Building and associated facilities were turned over to the Laboratory July 15, 1957. The first

six months of the year were spent in designing major additions and equipment, in fabricating and procuring equipment, and in preparing for testing and operation. A mockup of the reactor mechanical controls was assembled and then tested under conditions simulating operation conditions as closely as possible. Further activities included training of personnel, performing hydraulic tests on the reactor, and preparing for the neutron tests. (A.C.)

3391 WKNL-75

Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
A CONCEPTUAL DESIGN OF A SHIELD TESTING AND MATERIALS IRRADIATION FACILITY. J. H. Frankfort. Nov. 20, 1956. 34p. For Glenn L. Martin Co. Contract NOa(s)56-891C.

A conceptual design is presented for a test reactor facility to be used for shielding experiments and component irradiations necessary for airframe development for the nuclear airplane program. To meet both requirements a modified swimming-pool reactor is used, with a dry irradiation cell of 320 cu ft of useful volume provided for component testing, while shielding experiments are performed in the pool in the usual manner. A BSR-type core is operated at 1 MW to provide a fast neutron flux in the irradiation cell of 10^{12}n/cm^2/sec at the core face and 10^{11} at a distance of 4 feet. The irradiation-cell facility is designed to avoid the need of remote operations in making up service connections to the experimental piece. The reactor is contained in a cylindrical building designed for 6 psi internal pressure to meet the conditions of the maximum credible accident. The estimated cost of the facility, including the reactor and the fabrication cost for an initial fuel charge, is $2,874,000. (auth)

3392 WKNL-83

Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
CONCEPTUAL DESIGN OF EXPERIMENT PLUG AND COFFIN ASSEMBLY. Aaron Baumgarten. Jan. 14, 1957. 30p. For Glenn L. Martin Co. Contract NOa(s) 56-891C.

A conceptual design and operating procedure are described for utilizing the HG-9 hole in the MTR reactor for fast-neutron irradiation of aircraft materials and components under dynamic conditions. These meet the requirements of the Martin experimental program and of the MTR operating staff. The experiment is supported in a sealed aluminum container at the end of a shielding plug made of aluminum, lead, and polyethylene. The experiment container may have maximum outside dimensions of 7⅞" wide by 14½" high. It is positioned just outside the reactor pressure vessel where the fast-neutron flux is 5×10^{11} n/cm^2 × sec, with an experiment present. The container will be coated with cadmium to screen out thermal neutrons. Service leads pass through the plug and are provided with quick-disconnect couplings at both ends. The irradiated experiment container can thus be disconnected by remote manipulators in a hot cell, making the plug available for re-use. However, a cooling period of about two weeks is needed before manual installation of a new experiment is feasible. This results in a total requirement of three similar experimental plugs to provide for a continuing experimental program that fits in with the MTR operating cycle of 21 days. The experiment plug is made shorter than the full length of the HG-9 hole to facilitate handling, and auxiliary shields of polyethylene and lead are therefore provided. The plug is transported in a movable lead and steel coffin, which also serves to transport the activated section of the graphite plug originally present in the HG-9 hole. The shield thickness tapers from front to back to minimize the coffin weight, which is 37½ tons. Two coffins are needed to meet the operating and scheduling requirements. The cost of the required equipment is estimated to be $144,000, including $17,000 for detailed engineering. (auth)

3393 AEC-tr-3470

PERSPECTIVES OF USING ATOMIC ENERGY IN GAS TURBINE CLOSED CYCLE APPARATUSES. A. I. Mikailov. Translated by Oak Ridge National Lab. Library Staff from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 1, 113-19(1958). 13p.

The results of a comparative analysis of a double-contour sodium-cooled closed-cycle atomic gas turbine power plant are presented, with helium, nitrogen, or carbon dioxide as the operating substance. Attention is directed mainly to heterogeneous reactors, and the discussion includes the advantages and disadvantages of the various gases used with liquid metal in the heat exchange systems. (J.R.D.)

3394

HEATING OF THE STRUCTURES AROUND A NUCLEAR REACTOR. A. N. Komarovskii. Atomnaya Energ. 5, 119-23(1958). (In Russian)

The effects of heating and radioactive emission from nuclear reactors on the enclosing concrete shielding are analyzed. Descriptions are given of various types of concretes. Data are presented on the mechanical properties and moisture content of concrete shielding exposed to heating and irradiation in operating reactors. Data are also given on materials used for reactor thermal shielding and methods of cooling the shield. (tr-auth)

3395

STUDIES IN THE PHYSICS OF FAST NEUTRON REACTORS. A. I. Leipunskii, A. I. Abramov, et al. Atomnaya Energ. 5, 277-93(1958). (In Russian)

A short review is given on the results of research with three experimental fast reactors, BR-1 (built in 1955), BR-2 (built at the beginning of 1956), and BR-3 (built in the middle of 1957), for experimentally determining the possible magnitudes of breeding coefficient and for checking the methods of reactor efficiency calculations. (R.V.J.)

3396

AN EXPERIMENTAL REACTOR USING GASEOUS FISSILE MATERIAL (UF_6). I. K. Kikoin, V. A. Dmitrievskii, et al. Atomnaya Energ. 5, 294-302(1958). (In Russian)

The construction and operational data are presented for an experimental reactor using UF_6 as fissile material. The reactor was constructed in order to study the chain reaction in gaseous UF_6, to correct the theoretical calculations, and to carry out research in reactor physics. The first experiments with UF_6 enriched up to 90% with U^{235} were achieved in August 1957. Reactor characteristics are: diameter of the active core (beryllium), 116 cm; height of the active core, 108 cm; thickness of the side reflector (graphite), 50 cm; thickness of the upper and lower reflectors, 60 cm; the lattice spacing, 8 cm; the number of rectangular cross section channels, 148; the gas volume in the active core, 213 liters; the beryllium weight in the active core, 1370 kg; the aluminum weight in the active core, 62.8 kg; the

critical mass (U^{235}), 2.024 kg; the critical mass (UF_6 with 90% content of U^{235}), 3.340 kg. Experiments show that by selecting favorable conditions it is possible to secure radiative stability of UF_6 in a reactor. (R.V.J.)

3397

COMPLEX AUTOMATION FOR REACTOR CONTROL. P. Kovanits and M. Kulka. Atomnaya Energ. 5, 403-11 (1958). Oct. (In Russian)

Two control systems are studied. In the first system, the detector controls the transition point according to the neutron flux constant. The system combines the measuring and signaling functions for the period, power, and subcriticality of the reactor. In the second system, the power of the reactor controls the transitions of the detector. This system combines the functions of automatic control of the subcriticality, period, and power of the reactor. By plotting both schemes, it is possible to detect two variations in the complex control. The first variation can be easily adapted to the existing installations while the second variation is more sophisticated and could be used only in future installations. (tr-auth)

3398

A METHOD OF CASTING RADIATOR-TYPE FUEL ELEMENTS FOR A NUCLEAR REACTOR. A. W. Hare and R. F. Dickerson. Modern Castings 112-4(1958) May.

A vacuum-casting technique using graphite molds and stainless steel coated by an electrophoretic process with magnesium oxide is described. Optimum casting and mold temperatures are given. (auth)

3399

FISSION POWER DISTRIBUTION NEAR A CRUCIFORM WATER GAP. E. R. Sanford and H. J. Litke (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 713-26(1958) Dec.

An experiment was conducted in a critical assembly to determine water channel power peaking in a heterogeneous, highly enriched, water-moderated reactor subassembly. In addition to horizontal profiles of power density in a plane below a bank of control rods, data were obtained on the interacting effects of the control rod channel and bottom reflector power peaks. Experimental techniques are discussed. A computation for a comparable multiregion cell was made using a few-group diffusion theory digital computer code. Comparison of the results showed that variations in fast neutron spectrum and in manner of homogenization of materials within cell regions had no appreciable effects upon the power density peak. The choice of thermal neutron spectrum is important. Agreement between all experimental values and calculations with a Maxwellian spectrum was excellent. The comparison between experiment and calculations with a hardened thermal neutron spectrum was relatively poor. The results of this investigation indicate that great care must be exercised in interpreting experimental data on power distribution, and that two-dimensional diffusion theory calculations of power density are substantially verified. The use of U^{235} monitor foils is recommended in order to obtain a true fission power distribution. It was found that variations in the water gap width of the order of 10% had negligible effect upon the horizontal peak-to-average power ratio in the fuel. The use of metallic control rod extensions was found to decrease the horizontal peak-to-average ratio substantially, the magnitude of the decrease verifying analytical predictions. (auth)

3400

VERIFICATION OF A METHOD FOR TREATING NEUTRON SPACE-TIME PROBLEMS. A. F. Henry and N. J. Curlee (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 727-44(1958) Dec.

An approximation method is proposed for calculating the detailed kinetic response of a reactor during a transient in which the space and time behaviors of the neutron flux are not separable. In order to test the validity of the method a particular transient is studied for a series of cores chosen so that the space-time behavior of the neutrons is nonseparable in varying degrees. A particularly simplified mathematical description of the neutrons allows an exact solution to be obtained and hence affords a means of verifying predictions of the approximation scheme. Agreement between exact and approximate calculations is encouragingly good. (auth)

3401

SELECTION OF A REACTOR CONTAINMENT STRUCTURE. Theodore H. Smith and Burr H. Randolph (Bechtel Corp., San Francisco). Nuclear Sci. and Eng. 4, 762-84(1958) Dec.

Many factors influence the design of a containment structure: size and shape of the reactor and other equipment to be housed, topographic and subsurface features of the site, proximity to populated areas, relative economy of construction materials, need for access during operation, and most important, pressure-volume duty. For a given duty, and for geometrically similar structures, the volume can often be varied over a broad range with little change in total cost. The upper limiting volume is reached when external forces rather than internal govern the design; the lower limit is usually the point where the membrane becomes unreasonably thick. Two or more small vessels connected together may have advantages over one large vessel, but additional design problems arise in making them act as a unit. The merits of total versus partial containment are discussed. A comparison is made of the various designs studied in selecting the containment vessel for the Dresden Nuclear Power Station. These included simple and composite structures, some above and some below ground, some designed for total and some for partial containment. A steel sphere for partial containment was selected as best suiting the needs of this project. (auth)

3402

PERTURBATION THEORY OF CONTROL ELEMENTS. I. Bertram Wolfe and David L. Fischer (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 4, 785-93(1958) Dec.

An exact expression for the reactivity effect of a control element placed in a reactor is derived within the limitation of validity of multigroup diffusion theory. The evaluation of the expression requires a knowledge of the flux distributions in the reactor with and without the element (s) inserted. Since the reactivity effect is stated in terms of the flux distribution in the perturbed and unperturbed reactors, one can calculate the effect of a control element if a good estimate for the form of the perturbed flux is made. A first-order perturbation calculation for thermally black control elements is presented. The perturbation calculation assumes that the fast flux is unaffected by the presence of the control element. The results are valid for a reactor in which the neutron age is large compared to the square of the

thermal diffusion length and for a control element which is small compared to both the size of the reactor and the square root of the age. (auth)

3403

SHIELDING THE ENRICO FERMI FAST BREEDER REACTOR. H. E. Hungerford and R. F. Mantey (Atomic Power Development Associates, Inc., Detroit). Nucleonics 16, No. 11, 120-5(1958) Nov.

The solution of the shielding problems encountered in the Enrico Fermi Reactor are given. The shield has been designed from common materials whose durability over the expected life of the plant is known and whose cost is low. These are graphite, steel, and concrete, all used in the primary, secondary, and biological shields. Special shields are necessary around the 30-in. primary-coolant outlet lines because of the large neutron leakage. Two materials were considered for this shield: (a) borated, diatomaceous-earth-aggregate lumnite concrete and (b) pressed calcium borate material. The latter was chosen as the shield. Temperatures to be expected in the primary-coolant pump and heat-exchanger plugs preclude the use of ordinary concrete as plug shields. The present design calls for a concrete made from serpentine rock aggregate in lumnite cement within the plug containers. Costs of the shielding materials are given. Elevation and plane views of the reactor give the locations of the shields. The shielding properties of the shields are presented graphically. (T.B.A.)

3404

CRITERIA FOR TEST REACTORS. Bertram Wolfe (General Electric Co., San Jose, Calif.). Nucleonics 16, No. 11, 135-7(1958) Nov.

To provide as many neutrons as possible for absorption experiments, a test reactor should be designed so that the thermal utilization (neutron leakage) is high. Generally, most of the leakage can be absorbed in the experiments if the core regions between experimental facilities are small. The cores of reactors with beam-port facilities should be small, with beam ports placed adjacent to the core. Reactors designed for in-core experiments should have the experimental facilities distributed throughout the core. High-performance reflectors should be used only for reactors in which in-core facilities represent the major experimental region. The design of a reflector must be examined in each case to see that it actually increases the flow of neutrons into the experimental regions rather than increasing flow into the moderator and structural material in the core. (T.B.A.)

3405

NUCLEONICS SURVEY OPERATING CRITICAL FACILITIES IN THE U. S. Nucleonics 16, No. 12, 44-5 (1958) Dec.

A survey of operating critical facilities in the United States is presented in tabular form. The survey includes the following information: owner, designer, location, name, startup time, capital investment, use or operating charge, number of cells, applications, specific reactor designs investigated to date, available for hire, and materials available. (J.H.M.)

3406

HIGH-TEMPERATURE CRITICAL FACILITY. J. A. Bistline and C. S. Hofmann (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 16, No. 12, 46-7(1958) Dec.

Information is presented on a high-temperature critical facility, the Proof Test Reactor designed by the Knolls Atomic Power Laboratory, and its experimental program. Design details of the primary water-system, auxiliary water system, pressure vessel, and core are given. This facility combines, for the first time, the flexibility of a critical assembly with the operation temperatures and pressures found in power reactors. It can operate at up to 500°F and 1250 psi, thus aiding more accurate design of pressurized-water reactors. (J.H.M.)

3407

PLANNING AND OPERATING A CRITICAL FACILITY. F. J. Jankowski and J. W. Chastain (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 16, No. 12, 48-50 (1958) Dec.

A summary is presented on planning and operating the critical facility at the Battelle Nuclear Research Center. Discussions are included on site selections, the ciritical-facility building, fuel design, hazards, assembly preparation, and operating rules. A floor plan for the facility is also included. (J.H.M.)

3408

CHARGING FOR TEST REACTOR SPACE. R. L. Murray (North Carolina State Coll., Raleigh) and M. A. Schultz (Westinghouse Electric Corp., Pittsburgh). Nucleonics 16, No. 12, 72-6, 78(1958) Dec.

Factors to be considered in developing a cost-rate structure that is applicable to charging for test-reactor space are discussed. Considerations are given to developing physical formulae that would aid in charging customers for space in irradiation facilities. (J.H.M.)

3409

NUCLEAR REACTOR CONTAINMENT VESSELS. A. N. Komarovskii. Moscow, Atomizdat, 1958. 66p.

A booklet intended for scientists and engineers designing and constructing nuclear reactors is presented. The basic aspects of the design and construction of containment vessels for nuclear reactors are discussed. Various types of containment shells, materials used in their construction, and the forces and stresses in containment shells are described. (J.S.R.)

3410

NUCLEAR REACTOR TECHNOLOGY. H. de Bruyn, M. Bustraan, et al. Gravenhage, Netherlands, Reactor Centrum Nederland, 1958. 355p. (In English and Dutch)

A series of articles on nuclear energy are presented. A survey of reactor theory is given, and three reasons for a disturbance of the critical state of a reactor are discussed. The physical processes which form the principles for the calculations on reactor shielding are surveyed. The reactors of the U.K. power program are described. An outline of the implications of physics on reactor fueling is given. The nuclear reactor in chemical technology is discussed. The influence of the coolant pressure and the pressure drop over the steam generators with respect to the heat exchange surface needed to transfer a certain amount of heat is discussed. Reactor vessels for gas-cooled reactors are described. The operation of gas-cooled, graphite-moderated reactors is surveyed. The results of six-years' operation of JEEP are presented. The Dutch Materials Testing and Research Reactor is described in detail. A brief description is given of the swimming pool reactor to be built at the University of Delft. A brief historical review is given of the operation of graphite research reactors, and the Belgian Reactor BR-1 is described in detail. The

application of research reactors to chemistry is discussed. (J.S.R.)

Power

Refer also to abstracts 3461 and 3464.

3411 AECU-3953
Duquesne Light Co., Shippingport, Penna.
INITIAL RADIATION SURVEY. SECTION II. Test Results DL-S-172 (T-612084). First Issue, Sept. 25, 1958. 13p. $3.30(ph OTS); $2.40(mf OTS).

The radiation levels in the Turbine-Generator Service Building, around the Fuel Handling Canal, and in the limited access areas of the plant containers during plant operation were determined. Test results at 37% and 100% reactor power indicate that the shielding employed in the above designated areas is satisfactory, and radiation levels were such that access may be permitted with no time limitation to the locations during plant operation. (auth)

3412 AECU-3954
Duquesne Light Co., Shippingport, Penna.
INITIAL RADIATION SURVEY. SECTION III. Test Results DL-S-172 (T-612084). First Issue, Oct. 20, 1958. 6p. $1.80(ph OTS); $1.80(mf OTS).

The radiation level in the concrete reactor plant container compartments during shutdown after the plant has been operating at power was determined. The maximum radiation detected in the 1AC concrete enclosure was in the vicinity of the 1A loop heat exchanger. The 1C loop was out of service and isolated during the power run, therefore, lower radiation would be expected in that vicinity. The lowest radiation detected in the 1BD was found near the 1D loop heat exchanger which is identical to the 1A loop. The highest radiation detected in the 1BD was in the vicinity of the 1B loop heat exchanger. The radiation level on the south side of the 1BD chamber was lower than found along the south side of the 1AC chamber although the 1C loop had not been in service. (auth)

3413 ASAE-S-7
American-Standard. Atomic Energy Div., Mountain View, Calif.
REACTOR PHYSICS OF H_2O-MODERATED POWER REACTORS. I. W. Richardson, J. W. Webster, E. J. Leshan, R. C. Morrison, and J. R. Burr. Feb. 1, 1958. 122p. Contract AT(04-3)-109. $2.75(OTS).

A systematic method is described for the multigroup evaluation of light-water moderated power reactors. Five-group models are derived for several uranium–water lattices for which there exists very complete experimental data which serve as a check for the theoretical results. Both the experimental and theoretical procedures are fully discussed. As a demonstration of the five-group models, the flux and power distributions are calculated for a uniform slightly enriched reactor and an equivalent seed-blanket type. (auth)

3414 CF-58-10-115
Oak Ridge National Lab., Tenn.
SUMMARY OF HRE-2 RUN 13 (INITIAL POWER OPERATION). J. R. Engel, P. N. Haubenreich, J. Hernandez-Fragoso, and D. M. Richardson. Oct. 28 1958. 61p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

The first power operation of the HRE-2, referred to as Run 13, occurred in February 1958. In five days of power operation, the maximum sustained power was 1.5 Mw and the total power generated was 48 Mw-hr. During the first part of the power operation, the fuel solution contained very little internal recombination catalyst. This part of the run was characterized by high concentrations of radiolytic gas and significant loss of reactivity at very low powers. After an addition of copper and acid, reactivity losses were observed only at higher powers. Power operation was terminated after samples showed high nickel concentrations in the fuel solution, indicating a very high stainless steel corrosion rate. Subsequent subcritical operation ended because of power wiring insulation failures. (auth)

3415 IGE-R-7
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
CALDER WORKS: THE RADIOLOGICAL DESIGN OF THE DISCHARGE PLANT. K. H. Dent and H. C. Knights. 1958. 14p. (IGC-TROC/R-4; IGC-TRDC/P-139).

The general basis of the radiological design of the plant is described, and dose rates are indicated for each operation together with annual integrated doses for each key operator. (auth)

3416 NAA-SR-2234
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RESULTS OF PRELIMINARY SHIELD ANALYSIS FOR THE 45.5 MW OMR. D. S. Duncan. Nov. 15, 1958. 70p. Contract AT-11-1-GEN-8. $2.00(OTS).

Calculations to determine preliminary bulk shielding and thermal shield requirements for the Organic Moderated Reactor have been completed. The methods used and the results obtained are described. (auth)

3417 NDA-14-40
Nuclear Development Associates, Inc., White Plains, N. Y.
THE EFFECT OF HYDROGEN IN A FAST POWER BREEDER REACTOR. F. A. Clark and W. H. Jens. June 21, 1954. Decl. Nov. 12, 1958. 16p. $3.30(ph OTS); $2.40(mf OTS).

Work performed under contract with the Detroit Edison Company and the Dow Chemical Company.

Because of the possibilities that H can be introduced into the reactor, calculations were made to obtain a rough estimate of the hazard involved. The effects on critical mass, breeding gain, reactivity, etc. were determined. (L.M.T.)

3418 TID-7021(Chaps. 1, 2, 3, and 5)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR REACTOR COMPONENT INSTRUCTION BOOK. [1958]. Chap. 1. INTRODUCTION. 18p. $3.30(ph OTS); $2.40(mf OTS). Chap. 2. DETAILED DESCRIPTION. 125p. $19.80(ph OTS); $6.30(mf OTS). Chap. 3. OPERATION AND PERFORMANCE. 63p. $10.80 (ph OTS); $3.90(mf OTS). Chap. 5. MAINTENANCE. 59p. $9.30(ph OTS); $3.60(mf OTS).

Chapter one gives general characteristics of the reactor. Chapter two explains the individual components of the reactor and their functional relation to the reactor as a whole and to each other. Chapter three describes the considerations that determine the final design of the reactor, the performance to be expected from it, and the capability and limitations of its several components. Chapter five describes the components of

the reactor for which preventive maintenance is anticipated. (W.L.H.)

3419 WAPD-PWR-TE-22

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] CORE 1 CONTROL ROD DRIVE MECHANISM PERIODIC TESTS. SECTION I. Periodic (First Issue). Test Evaluation DL-S-148 (T-550011). P. W. Secrist and E. G. Shockey. Sept. 17, 1958. 11p. Contract [AT-11-1-GEN-14]. $3.30(ph OTS); $2.40(mf OTS).

The purpose of performing the PWR control rod mechanism periodic tests is to determine the individual mechanism operating characteristics which would bring to light any malfunctioning. (auth)

3420 YAEC-81

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

DEVELOPMENT OF EQUATIONS FOR ANALOG COMPUTER STUDIES TO SIZE THE REACTOR PLANT PRESSURIZER. W. G. Lyman. Oct. 15, 1958. 16p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

The assumptions and equations used to conduct reactor plant load transient studies on the analog computer are presented. The study was performed to determine the magnitude of reactor cooling water temperature and volume variations caused by secondary plant load transients, and to establish the size of the pressurizer which would be capable of limiting the cooling water pressure variations caused by the volume surges. (auth)

3421

ATOMIC ENERGY PLANTS FOR AIRCRAFT. J. W. Shortall. Atomkernenergie 3, 450-4(1958) Nov. (In German)

The article on the use of nuclear reactors as power sources for aircraft is concluded by a consideration of the shielding problems. The research program in the United States on the development of nuclear aircraft is briefly discussed. Nuclear powered missiles and rockets are mentioned. (J.S.R.)

3422

EFFECT OF NEUTRON TEMPERATURE ON THE DURATION OF RUNS AND ON FUEL BREEDING IN A POWER REACTOR. A. K. Krasin, M. E. Minashin, and V. J. Sviridenko. Atomnaya Energ. 5, 111-18 (1958). (In Russian)

Effects of neutron temperature on the duration of reactor runs, Pu^{239} breeding, and electrical power production were calculated. The active zone of a sodium-graphite reactor was studied in two variations: with zirconium cladding and steel cladding. It was found that the most economical neutron temperature, for this type of reactor, is 900 to 1000°F. The dependence of duration of runs and the efficiency coefficient on the neutron temperature was investigated with the homogeneous sodium-graphite reactor and the heterogeneous uranium graphite gas-cooled reactor. Results of calculations are presented graphically. (tr-auth)

3423

MEASUREMENTS ON THE NEUTRON SPECTRUM IN THE THERMAL COLUMN OF A POWER STATION REACTOR. A. P. Senchenkov and F. M. Kuznetsov. Atomnaya Energ. 5, 124-9(1958). (In Russian)

Descriptions are given of a photosensitive neutron monochromator used for measuring neutron spectra in the energy range 0 to 0.5 ev. Measurements of neutron spectra for a power reactor thermal column are presented. Neutron flux discontinuities were observed at neutron velocities of 600, 1000, and 1650 m/sec; the causes of such discontinuities were analyzed, and evaluations were made of the cross section magnitude for inelastic scattering of neutrons on graphite. The temperature of the neutron gas determined by the method of least squares was 354°K at a graphite temperature of 304°K. (tr-auth)

3424

THE FUTURE OF NUCLEAR POWER IN THE USSR. V. S. Emel'yanov. Atomnaya Energ. 5, 217-22(1958). (In Russian)

A review is given of research and planning for future uses of reactor power plants in the USSR. (R.V.J.)

3425

A URANIUM–GRAPHITE REACTOR PRODUCING SUPERHEATED HIGH-PRESSURE STEAM. N. A. Dollexhal, A. K. Krasin, et al. Atomnaya Energ. 5, 223-44(1958). (In Russian)

The construction of a 400-Mw atomic power plant powered by a uranium–graphite reactor, similar to the one already in operation but with higher technological and economic efficiency, is described. Reactors fueled with low-enrichment (1.3%) uranium operate with two channel groups. The heat released by the first channel group is transferred by the boiling water under 150 to 160 atm to the steam generator of the second circuit. From the generator the steam under 100 atm enters into the second group of channels where it is reheated to the required point and directed into the steam turbine. The reactor and the turbogenerator of 100-Mw capacity with their aggregates constitute a separate union. The sectional construction simplifies the operation and increases the dependability of the power production for the industrial needs of the district. The experimental research and the basis for selection of reactor parameters are discussed. The cross section of the power plant and the reactor, the channel distribution scheme, and the design of the rods and the control system are presented graphically as well as the nomographs for calculations of the starting and transition operations of the reactor unit to turbogenerator. (R.V.J.)

3426

DOUBLE WATER CIRCUIT POWER REACTORS IN THE USSR. S. A. Skvortsov. Atomnaya Energ. 5, 245-56 (1958). (In German)

An engineering design is presented for a boiling water prototype power reactor in the USSR. The capacity of the reactor is 760 Mw, and it supplies three steam 70-Mw electric power turbines. The efficiency of the power plant is 27.6%. The active zone is encased in a container 3 m in diameter and 2.5 m high and contains 343 fuel rods with 6 emergency control rods. The fuel rods are 10.2 mm in diameter with 8.8 mm diameter core of sintered uranium dioxide. The length of the active part of the elements is 2.5 m. The fuel cladding and the walls of the cells are made of zirconium alloyed with niobium. The reactor is fueled with 1.5% enriched uranium. The working cycle is 1.5 years with partial reloading every 6 months. The first loading contained 23 tons of 1.5% enriched uranium and 17 tons of natural uranium. The construction and shape of fuel elements are the same for both types of initial load. Reactor control is achieved by movable elements with absorbing materials. Justification for selecting the above described parameters is

discussed, and calculations and comparisons of various boiling reactors are included. (R.V.J.)

3427

A NUCLEAR ICE BREAKER. A. P. Aleksandrov, I. I. Afrikantov, et al. Atomnaya Energ. 5, 257-76(1958). (In Russian)

The engineering design and specifications are given for the nuclear icebreaker "Lenin" which was launched in 1956 in Leningrad and which is under reconstruction now. The icebreaker is of turboelectric type with a continuous navigation time of 1 year. The length of the icebreaker is 134 m, the width 26.7 m, the shaft horsepower 44,000, the tonnage 16,000, a maximum speed in deep quiet water of 18 knots, and a continuous speed in 2.4 m thick ice of 2 knots. The icebreaker has three screw propellers. The maximum number of revolutions at maximum speed of the center propeller is 185 rot/min and of the board propellers 205 rot/min. The height of the board at the middle is 16.1 m, and the draft is 9.2 m. The screw propeller thrust accelerated at the front speed at mooring is 330 tons. The weight of the power plant including the shielding (total) is 3017 tons, or (specific) 68.5 ton/hp. The shield weight is 1963 tons, and the total weight of the mechanical installation (including the electric motors for propellers and power plant but without nuclear power plant) is 2750 tons. The total steam capacity is 360 tons/hr. The steam parameters are (temperature) 310°C and (pressure) 28 atm. The steam consumption for main generators is 204 tons/hr. The efficiency of the auxiliary steam boiler is 10 tons/hr, and the capacity of the auxiliary power plant is 6200 kw. The icebreaker is powered by three individual reactors; there is a 100% reserve for circulating the pumps. The power plant is divided into two separate units located at the prow and stern of the ship. The third reactor is used only in an emergency. The power plant layout and cross-sectional view of the reactor are presented. The reactor characteristics are: diameter, 1 m; height, 1.6 m; fuel, sintered uranium dioxide 5% enriched with U^{235}; loading (with U^{235}), 85 kg; sheath material, zirconium alloy or stainless steel; burnout control material, a natural mixture of boron isotopes; the thermal capacity, 90 Mw; the maximum thermal load (considering the curve of the energy losses), $\sim 10^6$ kcal/m^2hr; the inlet water temperature, 248°C; and the outlet water temperature, 325°C. The steam generators, the automatic control system, and the circulating pump are shown. (R.V.J.)

3428

PHYSICAL AND ENGINEERING PROBLEMS IN SMALL SIZE PROTECTIVE SHIELD DESIGN. V. I. Kukhtevich and S. G. Tsypin. Atomnaya Energ. 5, 393-402(1958). Oct. (In Russian)

The physical problems in designing small size protective shielding for transportation type nuclear reactors were studied. The reactor emissions, γ-ray penetration through the shield, and the shadow protection are discussed. Engineering problems of the layout, materials, and the distributions of layers in the shield are analyzed. (tr-auth)

3429

ON THE OPTIMUM PARAMETERS FOR THERMAL CYCLE OF AN ATOMIC POWER STATION. V. M. Datskovskii. Atomnaya Energ. 5, 460-2(1958). (In Russian)

Calculations are made of reactor cosine heat release and permissible maximum temperatures for heat-releasing elements for several cycles in the power circuit, with variable mean temperature of the heat supply. (R.V.J.)

3430

REACTOR FUEL CYCLES. J. J. Syrett. Chem. Weekblad 54, 223-6(1958).

The point, channel, and bulk discharge methods of charging reactor fuels in power reactors are compared from the economic aspects. Special emphasis is placed on the possible operating methods for a natural uranium reactor on a "once-through" fuel cycle, in which fuel is rejected after irradiation. (auth)

3431

PROPULSION OF SHIPS BY STEAM TURBINE MACHINERY. T. W. F. Brown. J. Joint Panel Nuclear Marine Propulsion 2, 57-114(1958) Oct.

Some illustrations of De Laval's pioneering work on the design of geared turbines are presented. Discussions are included on the design of modern steam turbine machinery for four specific classes of vessel, namely, cross-channel steamers, destroyers and escort vessels, liners and cargo liners, and oil tankers and ore carriers. The differing duties of these classes of ships are outlined, and their influence on machinery design is illustrated by a number of typical steam turbine designs for each class. The nuclear propulsion of ships, with particular reference to large tankers, is considered in detail. The properties and relative merits of five possible types of nuclear reactor are summarized, and some notes are included on the problems of shielding and containment, which are particularly critical for marine plants. Three alternative designs of a nuclear power plant are given for a 60,000-ton tanker using the following reactors: the graphite-moderated, gas-cooled; the pressurized water; and heavy-water-moderated, gas-cooled. The relative merits of these three types of plants are discussed. The influence of fuel enrichment on the graphite moderated reactor is illustrated and comparative engine room arrangements are given to show this effect. Some data are given on the costs of nuclear power plants. (J.H.M.)

3432

PLUTONIUM FAST POWER BREEDER WITH OXIDE FUEL AND BLANKET ELEMENTS. John B. Sampson and E. A. Luebke (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 745-61(1958) Dec.

A fuel element consisting of plutonium and uranium oxide in steel tubing and capable of a large fraction of fuel burnup is described. As this fuel element makes possible recovery and refabrication with fewer steps than are required for a metal fuel element, lower recycle costs result. Breeders with fuel and fertile material in both oxide and metallic form were analyzed by the multigroup method on the UNIVAC for the purpose of comparing characteristics. A summary of the calculations is presented. The decrease in the breeding ratio resulting from the replacement of the metal core by oxide is only 0.2, a small effect in a future nuclear power economy where plutonium will have a low value as fuel rather than a high value as weapon material. Use of an oxide blanket may further reduce the breeding ratio by 0.05. An illustrative design is presented which has five atoms of uranium per atom of plutonium in the core and 45% sodium, a breeding ratio of 1.4 and a critical mass of 400 kg. Incremental refueling is assumed to reduce the control range required for 50% burnup of the original fuel loaded. (auth)

3433

THERMAL DESIGN CRITERIA FOR PRESSURIZED WATER REACTORS. W. M. Jacobi, J. D. Roarty, N. C. Sher, K. M. Treadwell, and J. E. Zerbe (Westinghouse Electric Corp., Pittsburgh). Nucleonics 16, No. 11, 130-4, 199(1958) Nov.

In an effort to establish reasonable thermal design criteria for water-cooled reactors, the Bettis Plant conducted an experimental program on boiling heat transfer and fluid flow. The following results are reported: a design equation to predict burnout heat flux as a function of mass velocity, bulk enthalpy, and local subcooling; a design equation to predict local boiling pressure drop for 0.097-in. rectangular channels; and bulk-boiling pressure drop data for 0.054- and 0.097-in. rectangular channels. The information given is specifically applicable to reactors with thin rectangular flow channels operating at 2000 psia, but for preliminary evaluation the data can be applied to reactors with lower pressures and different flow geometries if the coolant flow is parallel to the fuel element. (T.B.A.)

3434

FIRST DETAILS OF A.I.'S EPITHERMAL Th BREEDER. R. J. Beeley (Atomics International, Canoga Park, Calif.). Nucleonics 16, No. 11, 162, 164, 166(1958) Nov.

The program for the development of the Advanced Epithermal Thorium Breeder Reactor (AETR) is outlined. The objective of the AETR program is to get enough information to permit a realistic economic evaluation of a full-scale power plant. The present concept of the AETR involves a core-and-blanket system. The core consists of solid fuel rods or tubes of Th–U alloy cooled with Na and moderated with graphite or Be; the blanket contains Th or ThO_2 rods also cooled with Na and moderated with graphite or Be. (C.W.H.)

3435

THE APPR ZERO POWER EXPERIMENTS. John W. Noaks (Alco Products, Schenectady, N. Y.). Nucleonics 16, No. 12, 51-4(1958) Dec.

A series of zero-power experiments were conducted at the Alco critical facility on an assembly composed of the fabricated elements and the APPR-1 core-support structure and control-rod drives. Discussions are presented on these experiments which gave final values for the mass, rod worths and temperature coefficients as well as other information that helped in the design of remaining parts of the reactor system. The assembly of the facility is described, and the procedures for the experimental program are included. (J.H.M.)

3436

COMPLETED AND PROJECTED WORK OF ELECTRICITÉ DE FRANCE IN THE NUCLEAR FIELD. J. P. Roux. Rev. gen. elec. 67, 351-64(1958) July. (In French)

A brief review is given of the general program of Electricité de France. A detailed description is presented of the first Chinon reactor, a graphite moderated unit with CO_2 cooling rated at 82 Mw. The total auxiliary load is 16 Mva supplied at 5.5 kv and 380 v, with a special 127-v system arranged for immediate changeover to stand-by diesel sets. The considerations dictating the choice of the main blower drive are outlined. (auth)

3437

THE CENTER OF PLUTONIUM PRODUCTION IN MARCOULE. Rev. ind. minérale 40, 483-9(1958). (In French)

In the French nuclear power stations Pu^{239} is produced from U^{238}. A detailed description is given of the Marcoule reactor and its operation. (J.S.R.)

3438

MOSHCHNYYEE ATOMNYYE ELEKTROSTANTSII. (High-Powered Nuclear Power Plants.) Georgiy Viktorovich Yermakov. Moscow, Izd-vo "Znaniye," 1958. 31p.

The construction of large industrial nuclear power plants in the USSR is discussed. A detailed description is given of the graphite–water reactors and water-moderated, water-cooled reactors used in the USSR. The development of nuclear power plants in the U.S.A., Great Britain, and France is discussed. (J.S.R.)

STABLE ISOTOPE SEPARATION

Refer to abstract 3458.

TECHNOLOGY

Raw Materials

3439 WIN-83

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH RESIN-IN-PULP PILOT PLANT TESTING OF MONUMENT VALLEY ORE. W. D. Charles and R. L. Shimmin. June 1, 1958. 46p. Contract AT(49-6)-924. $7.80(ph OTS); $3.30(mf OTS).

During the period of November 27, 1955, through January 31, 1956, various portions of the Monument Valley ore, Monticello Stockpile 46, were treated in the Alkaline Leach Resin-In-Pulp Pilot Plant at Grand Junction, Colorado, to study ion exchange characteristics with a low uranium to vanadium ratio in the ion exchange feed. The uranium to vanadium concentrations were such that a ratio as low as 1.5:1 was attained with no detrimental effect on the ion exchange characteristics. The report contains detailed information on grinding, leaching, sand-slime separation, ion exchange, and precipitation as related to the processing of this ore. (auth)

3440 WIN-100

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

CONTINUOUS COUNTERCURRENT SOLVENT LEACHING. Paul Galvanek, Jr. July 16, 1958. 46p. Contract AT(49-6)-924. $7.80(ph OTS); $3.30(mf OTS).

Continuous countercurrent non-aqueous leaching techniques are described for the recovery of uranium directly from a variety of conditioned ores. No preliminary gangue separation is involved. Product grades exceeding 99% U_3O_8 are achieved. Several methods for uranium solubilization and ore conditioning by the acid-cure technique are described. Both primary and secondary ores were successfully treated. A bibliography of literature pertaining to the solvent leaching technique from its inception is included. (auth)

3441

ORE MINING AND TREATMENT. A. T. Climas. Atomic Energy (Sydney) 1, No. 4, 7-12, 14(1958) Sept.

A description is given of the mining techniques used at the Mary Kathleen uranium project in North Queens-

land. A simplified flowsheet for the treatment of the ore is given and is briefly discussed. (J.S.R.)

3442

SOLVENT EXTRACTION IN THE MINING INDUSTRY. C. J. Lewis and James L. Drobnick (Colorado School of Mines, Golden). Ind. Eng. Chem. 50, No. 12, 53A-5A(1958) Dec.

Approximately one third of all uranium ore mined in the United States is either processed or soon to be processed by solvent extraction. This process permits a minimum of reagent inventory and operating labor, and maximum process flexibility. It requires a minimum of capital outlay and space requirement. In operation, a water-immiscible organic phase is intimately mixed with the uranium-pregnant sulfuric acid leach solution, whereupon the uranium, with some impurities, enters the organic phase. The two-phases are then separated by virtue of their immiscibility and the uranium-barren aqueous phase, "raffinate," is usually wasted. The uranium-loaded organic phase is then mixed with an aqueous stripping solution which removes the uranium while simultaneously conditioning the organic phase for recycle. By adjustment of the relative volumes of aqueous feed and aqueous stripping solution, a relatively high concentration of uranium is obtained in the aqueous product. A schematic diagram of the process is presented, and a diagram of a typical process flowsheet is included. (J.H.M.)

3443

ION EXCHANGE APPLICATIONS IN THE MINING INDUSTRY. Harold E. Weaver and Alvin G. Winger (Rohm & Haas Co., Philadelphia). Ind. Eng. Chem. 50, No. 12, 56A-8A(1958) Dec.

New developments, procedure costs, and marketing problems in the use of ion exchange systems for processing uranium ores are reviewed. Discussions are included on: the strong base anion exchange process, the resin-in-pulp process, and attempts to apply ion exchange to the recovery of metals such as nickel, cobalt, and copper. (J.H.M.)

3444

FLUIDIZATION TECHNIQUES IN PRODUCING REFINED URANIUM FROM ORE CONCENTRATES. A. A. Jonke, N. M. Levitz, Albin Litty, and Stephen Lawroski (Argonne National Lab., Lemont, Ill.). Ind. Eng. Chem. 50, 1739-43(1958) Dec.

A refining process is discussed where uranium ore concentrates are converted to impure uranium hexafluoride by hydrogen-reduction, hydrofluorination, and fluorination, and then purified by fractional distillation. The development of the reduction and hydrofluorination steps of the refining process is described. In developing the process, a variety of concentrates representative of those produced in various plants were studied. Preliminary studies were done in bench-scale, fluid-bed reactors, and further work was carried out on a pilot scale using equipment which was originally installed for work on refined uranium oxides. (J.H.M.)

3445

FLUIDIZED-BED TECHNIQUES IN PRODUCING URANIUM HEXAFLUORIDE FROM ORE CONCENTRATES. G. J. Vogel, Oscar Sandus, R. K. Steunenberg, and W. J. Mecham (Argonne National Lab., Lemont, Ill.). Ind. Eng. Chem. 50, 1744-7(1958) Dec.

A method for producing uranium hexafluoride by fluorination of crude uranium tetrafluoride is described. Instead of removing metallic impurities from the ore concentrate by solvent extraction before reduction, the concentrate is reduced directly and impurities are removed at different points in the processing, mainly from the fluorinator. Distillation of volatile impurities from the crude uranium hexafluoride completes the purification. Because of their known efficiency in gas-solid-type reactions, fluidized-bed reactors are used. A schematic of the pilot-plant fluid-bed fluorinator is shown. The fluorinator consists of three systems: gas-metering, reactor, and condensing. (J.H.M.)

3446

PRECIPITATION OF URANIUM TETRAFLUORIDE FROM AQUEOUS SOLUTION BY CATALYTIC REDUCTION. R. J. Allen, H. G. Petrow, and P. J. Magno (National Lead Co., Winchester, Mass.). Ind. Eng. Chem. 50, 1748-9(1958) Dec.

While attempting to produce dense, high-purity uranium tetrafluoride from uraniferous ores, a catalytic process was discovered for the reduction of uranyl ion in the presence of fluoride to yield UF_4. Most of the research was conducted with solutions prepared from sulfuric acid leach liquors of uraniferous ores. The solvent extraction process used was essentially the Amex process developed at Oak Ridge, although extensive changes were made in the stripping circuit to accommodate the use of hydrochloric acid. Hydrofluoric acid was added to the concentrated uranium solution, generally in slight excess of the stoichiometric requirement, and various sbustances were examined as possible uranium reductants. Among the reducing agents studied were stannous chloride, cuprous chloride, chromous chloride, titanous chloride, and sulfur dioxide. All but sulfur dioxide were effective reducing agents. The salts obtained were all identified as $UF_4 \cdot {}^3/_4\ H_2O$. The quantitative recovery of uranium as pure, dense UF_4 was demonstrated, and at significant cost savings over present techniques. (J.H.M.)

3447

SOLVENT EXTRACTION WITH ALKYL AMINES. C. F. Coleman, K. B. Brown, J. G. Moore, and D. J. Crouse (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 50, 1756-62(1958) Dec.

The chemistry of extraction by organic solutions of amines and their salts is described. Several hundred organonitrogen compounds were tested for their extraction performance. Out of the compounds tested, simple amines of molecular weights in the range of 250 to 600 generally gave a more favorable extraction performance. Some of the reagents are commercial mixtures of compounds in isomeric or homologous series. This includes the iso-octyl-, tridecyl-, and trialkylmethyl groups. Extractions by the three classes of amines are similar, and also parallel to sorptions by the amine or alkylammonium groups in anion exchange resins. It is concluded that the liquid-form extractants make amine extraction more versatile than resin sorption. (J.H.M.)

3448

ELECTRODIALYTIC CONVERSION OF URANYL NITRATE TO URANIC FLUORIDE SALTS. Wallace W. Schulz, Erwin W. Neuvar, Jimmy L. Carroll, and Raymond E. Burns (General Electric Co., Richland, Wash.). Ind. Eng. Chem. 50, 1768-70(1958) Dec.

An electrodialytic process for alkali metal and

ammonium uranium(IV) double fluorides is described. Essential features of the process, together with pertinent developmental data and a chemical flowsheet, are discussed. This electrodialytic process can be operated on a continuous basis at 80 to 85% current efficiency and involves fewer steps than the conventional method. A simple schematic of the process is shown. (J.H.M.)

3449

REMOVAL OF SOME VOLATILE IMPURITIES FROM URANIUM HEXAFLUORIDE. Whitney H. Mears, Robert V. Townend, Robert D. Broadley, A. D. Turissini, and Richard F. Stahl (Allied Chemical Corp., Morristown, N. J.). Ind. Eng. Chem. 50, 1771-3(1958) Dec.

Vanadium impurities were removed from crude uranium hexafluoride by a combination distillation method involving selectively condensing, solidifying, and separating solid vanadium oxyfluoride from the vapor. Accurate data on the solubility of fluorides in uranium hexafluoride, liquid-vapor equilibrium studies, and distillation experiments are presented. A cylindrical static equilibrium chamber fitted with sampling values at the top and bottom was used in the vapor-liquid studies. A schematic of this apparatus is shown. (J.H.M.)

3450

PRODUCTION OF URANIUM TETRAFLUORIDE. THERMAL DAMAGE EFFECT. Carl W. Kuhlman, Jr. and Bruce A. Swinehart (Mallinckrodt Chemical Works, St. Louis). Ind. Eng. Chem. 50, 1774-6(1958) Dec.

Some problems are discussed on thermal effects on reduction and hydrofluorination reactions when uranium tetrafluoride is produced from uranium trioxide. A study of the problems indicates that the properties of the reacting solids are altered at high temperatures to hinder completeness of hydrofluorination. Because the bed temperature of the reacting solid has an important effect on the rate and completeness of both reactions, the behavior of the uranium trioxide depends on the size of the sample, the apparatus, and the detailed manner in which the two reactions are carried out. Because of the thermal damage effect in reacting solids, the intrinsic reactivity of an oxide is not necessarily proportional to the amount of conversion to uranium tetrafluoride obtained in a particular green salt process. A particularly active uranium trioxide may lead to a poor conversion to uranium tetrafluoride in a commercial process that produces a satisfactory product from a less reactive starting material. (J.H.M.)

3451

SOLVENT EXTRACTION WITH ALKYL PHOSPHORIC COMPOUNDS. Charles A. Blake, Jr., Charles F. Baes, Jr., and Keith B. Brown (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 50, 1763-7(1958) Dec.

The solvent extraction of uranium with dialkylphosphoric acids, monoalkylphosphoric acids, trialkyl phosphates, dialkyl alkylphosphonates, and phosphine oxide is described. The extraction of alkali metals, alkaline earths, yttrium, lanthanum, lanthanides, titanium, zirconium, and hafnium with alkyl phosphoric compounds is also included. It is concluded that these new reagents, unlike tributyl phosphate, have the advantage of recovering uranium from nearly any solution. Schematics are shown of the Dapex and the monoalkylphosphoric acid processes. (J.H.M.)

PATENTS

3452

REACTOR FUEL ELEMENT BUILT UP FROM INDIVIDUAL SHEETS. Heinz Maier-Leibnitz. German Patent Application M 30838 VIIIc/21g. Atompraxis 4, 386(1958) Oct. (In German)

3453

HOMOGENEOUS BOILING REACTOR IN WHICH THE HEAT TRANSFER SURFACES ARE ARRANGED WITHIN THE REACTOR VESSEL. (to Verein. Kesselwerke AG, Büsseldorf, Germany). German Patent Application V 11997 VIIIc/21g. Atompraxis 4, 386(1958) Oct. (In German)

3454

SIMPLIFIED PRODUCTION OF CLAD FUEL ELEMENTS BY THE EXTRUSION METHOD. (to Atomic Energy of Canada Ltd.). German Patent Application A 26407 VIIIc/21g. Atompraxis 4, 386(1958) Oct. (In German)

3455

NEW TYPE OF URANIUM RECOVERY. Robert Klement. German Patent Application K 27642 VI/40a. Atompraxis 4, 387(1958) Oct. (In German)

3456

BONDING OF ZIRCONIUM TO OTHER METALS. K. F. Alder and M. L. Noakes (to United Kingdom Atomic Energy Authority). British Patent 794,671. Nuclear Eng. 3, 556(1958) Dec.

A sheath of zirconium or zirconium alloy is bonded to a core of fissile-bearing metal or alloy by hot-rolling at 550-650°C. The sheathed core is encased in copper and the assembly evacuated before rolling to prevent oxidation. (auth)

3457

COUPLINGS FOR VACUUM INSULATED PIPELINES. P. M. C. Lacey (to United Kingdom Atomic Energy Authority). British Patent 794,761. Nuclear Eng. 3, 556(1958) Dec.

The pipelines for liquefied gas have spigot and socket joints, but make contact only through a (rubber) scaling ring so that an annular space remains between spigot and socket forming a pocket in which the liquid conveyed tends to boil. This boiling liquid forms an insulating gas seal. (auth)

3458

PROCESS FOR THE SEPARATION OF GASEOUS OR VAPOROUS SUBSTANCES, MORE ESPECIALLY ISOTOPES. E. W. A. Becker (Germany). British Patent 794,834. Nuclear Eng. 3, 556(1958) Dec.

The mixture to be separated issues from a nozzle-like opening in the form of an expanding jet. The jet is separated by an apertured diaphragm in its path into a peripheral portion and a core portion the latter passing through the aperture. A mixture of 98.5 mol% of hydrogen and 1.5 mol% of deuterium was subjected to the process using a nozzle of 0.47 mm smallest diameter and a conical diaphragm with an opening of 2.2 mm spaced from the nozzle opening 3.1 mm. The pressure was 15 mm Hg ahead of the nozzle. In the chamber around nozzle mouth and diaphragm the pressure was 2×10^{-2} Hg and in the chamber behind the diaphragm 1×10^{-2} Hg. The separation factor A was 1.37—0.02. (Separation factor A = Nh(1—Nv)/Nv(1—Nh) where Nh is

the molar fractions of the component with the higher molecular weight behind (h) and in front (v) of the diaphragm in the direction of flow.) (auth)

3459

TUBULAR FUEL ELEMENTS FOR NUCLEAR REACTORS. H. Lloyd and A. Blainley (to United Kingdom Atomic Energy Authority). British Patent 794,901. Nuclear Eng. 3, 556(1958) Dec.

The fuel elements as rods or bars are longitudinally arranged in a circle within the wall of an encasing tube. A beryllium tube, e.g., provided with longitudinal bores receives uranium rods in these bores which are then closed by beryllium plugs welded to the wall by argon arc welding. Other closing methods may also be used. Sodium or its alloys may be introduced as an intermediate heat transfer medium. (auth)

3460

RETAINING DEVICES FOR FUEL ELEMENTS IN GAS-COOLED NUCLEAR REACTORS. G. E. Robinson (to United Kingdom Atomic Energy Authority). British Patent 794,891. Nuclear Eng. 3, 556(1958) Dec.

Gas pressure may expel fuel elements from the horizontal coolant channels. Then a new string of elements has to be introduced and the discharged elements have to be reprocessed. In order to prevent this happening, retaining devices are attached by a coupling at one end of the coupled string of fuel elements and hooks at the other end engaging the face of the reactor core. The hooks are in the form of pivoted cranks with a locking member to lock them in position. These members can be unlocked to release the cranks from their engagement with their reactor core. (auth)

3461

METHOD AND PLANT FOR RECOVERING THE HEAT PRODUCED BY CHEMICAL, PHYSICO-CHEMICAL AND PHYSICAL REACTIONS. (To Electricité de France-Service National (France)). British Patent 795,007. Nuclear Eng. 3, 556(1958) Dec.

In nuclear reactions, cooling fluid may take part in the reaction and an efficient recovery of the heat carried along is obtained only by using as an operative fluid a condensable fluid (steam). In the path of the cooling fluid is inserted a steam generator or several generators which produce steam at different pressures fed to separate turbines or turbine stages. It means in any case considerable losses and/or intricate conduit arrangements. Now it has already been proposed, in French P. No. 1,085,116 of Electricité de France, to follow up the transfer of the coolant heat to water with the transformation of the heated water into saturated or superheated steam by an auxiliary source of heat (fuel in a firebox of a boiler). The new method consists of the transfer of at least a fraction of the heat to be recovered to water under pressure, a fraction of which is transformed into steam by pressure reduction, the steam then being superheated by the heat in another fraction of the water. The energy of the steam is finally converted into mechanical or electrical energy. (auth)

3462

RADIOACTIVE OIL PRODUCTION. (To Bendix Aviation Corp. (U. S. A.)). British Patent 795,028. Nuclear Eng. 3, 556(1958) Dec.

Oils containing radioactive substances (tracer oils) are readily detected, even in minute quantities and in inaccessible locations but tracer oils are limited in variety, expensive and relatively short-lived owing to the limited half-life of the radioactive isotope. The radioactive substance to be incorporated is obtainable from plants under the control of the Atomic Commission and any available radioactive isotopes in aqueous solution may be used to this solution. Oil and the aqueous alcohol solution are emulsified and clarified with a dispersant. Alcohol, water and dispersant are then removed by heating to above the boiling point of the components but remaining below the boiling point of the oil. The costs can thus be reduced to a fifth of the present price, a wide variety of oils can be used and the half-life may be increased from, e.g., 8 days for radioactive iodine to 2.3 years for radioactive caesium.

3463

APPARATUS FOR DETECTING IONIZING RADIATION. (To Philips Electrical Industries, Ltd. (U. S. A.)). British Patent 795,036. Nuclear Eng. 3, 556(1958) Dec.

Because of the production of two types of output pulses, main pulses and escape pulses, it has often been impossible to obtain accurate results or to distinguish between the two types. The new apparatus works with two detector tubes one of which is exposed to the primary radiation to be detected and is capable of emitting escape radiation, while the second tube is exposed to this escape radiation but screened from the primary radiation. Both tubes produce in response to the ionizing radiation electrical indications which appear on an output terminal individual to that tube but connected to a utilization circuit common to the two tubes and adapted for comparing the outputs. (auth)

3464

NUCLEAR REACTORS. H. R. C. Pratt. (To United Kingdom Atomic Energy Authority). British Patent 795,406. Nuclear Eng. 3, 556(1958) Dec.

Boiling-water reactors in which the coolant also acts as a moderator suffer from fluctuations in the power output, owing to ebullition. In order to keep the coolant density in the core constant, the vertical fuel elements are set in coolant tubes with an annular space between the smooth outer face of the element and the inner wall of the tube. The shape and dimensions are so chosen that a smooth continuous surface is provided for the support of a climbing film of liquid when the reactor is in operation with the coolant under a certain pressure fed at a certain rate. Towards the upper end of the tube where the climbing film ceases and only the vapor phase remains in the tube, ceramic fuel elements are provided which can be allowed to run dry and superheat the vapor. (auth)

3465

PERFORMANCE OF NUCLEAR FISSION REACTIONS AND APPARATUS THEREFORE. (To Stichting Reactor Centrum Nederland (Netherlands)). British Patent 795,421. Nuclear Eng. 3, 556(1958) Dec.

In a reactor system employing a suspension of solid fissile material in a moderating carrier liquid (ordinary or heavy water) it is desirable to maintain a predetermined concentration of the fuel suspension in every part of the reactor vessel. A good control has been achieved by a regulated downward flow of the suspension as described in B.P. 783,985 (Stichting Reactor Centrum Nederland). It has now been found that good control is also possible if the suspension is circulated upwardly through a reactor with vertical passages of

uniform cross-section provided the suspension is kept in laminar flow and the velocity of the carrier liquid and the concentration of the fissile material is appropriately controlled. The velocity of the upward liquid flow must be greater than the settling rate of the fissile material in a static body of the liquid. The concentration of the suspension need not be uniform over the horizontal cross-section of the vessel. The essential condition is that it is vertically constant at any place across the vessel. (auth)

3466

LOWERING MECHANISM. G. E. Lockett (to United Kingdom Atomic Energy Authority). British Patent 795,511. Nuclear Eng. 3, 556(1958) Dec.

The velocity of a falling weight is controlled by an energy absorbing device (fly wheel driven through a free-wheel device) so that the weight falls quickly at first, then after reaching a velocity peak travels at a reduced rate until most of its kinetic energy has been taken up by the rotating flywheel. (auth)

3467

CONTROL MECHANISMS FOR NUCLEAR REACTORS. G. E. Lockett. (To United Kingdom Atomic Energy Authority). British Patent 795,565. Nuclear Eng. 3, 556(1958) Dec.

The rod control is effected by a drive nut on a hollow threaded shaft. The shaft is connected to the control rod by an electromagnet on the shaft and an armature on the rod. The drive nut is driven through a clutch capable of slipping when the nut is arrested. On releasing the coupling between rod and shaft the control rod falls under gravity into a "shut-off" position.

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